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CENTRAL INTELLIGENCE AGENCY

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1. Attached is a copy of a translation of a Soviet Army manual, Atomic Weapons and Actions under Conditions of Their Employment, published by the Military Printing Office, Ministry of Defense of the USSR, and sent to press on 11 August 1954. It carried publication No. 4/7557 and censorship No. G-02037.

2. This translation is being disseminated in the interest of speed and, although not containing all the language refinements of the original Russian text, closely follows the text.

3. Photostatic copies of the figures to accompany the text of the translation will be disseminated as CSDB-35586a as soon as they can be produced.

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INFORMATION REPORT INFORMATION REPORT

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ATOMIC WEAPONS
and actions under conditions of their employment

COPY

SECRET

MINISTRY OF DEFENSE OF THE USSR

ATOMIC WEAPONS AND ACTIONS UNDER CONDITIONS OF THEIR EMPLOYMENT

A MANUAL FOR SERGEANTS

MILITARY PUBLICATION
OF THE MINISTRY OF DEFENSE OF THE USSR
MOSCOW-1954

/In the original Russian text of this document, page 2 was a blank page between the cover page and the Introduction./

/The original document contains a total of 96 explanatory figures which are referred to throughout the text but which will be disseminated as soon as reproduction can be completed.

Generally, parentheses in the following translation represent parentheses in the original text. They are used to define by example the type of item referred to, or for transliterated Russian terms which were not translated because of obscurity of meaning.

Brackets appearing under a figure contain an explanation as to content of the figure. Brackets are also used in cases where the translator felt it necessary to clarify the meaning of a term.

In other respects, too, the format of the translation follows closely the format of the original Russian text, except for pagination; therefore, certain technical terminology may not entirely agree with U.S. terminology.

It should be noted that the Soviet Army nomenclature as applied to tactical units is peculiar in that a number of different terms are used for "unit", depending on the size and relative dependence of the unit. Two of the terms most frequently used in this text in connection with units are:

a. Podrazdeleniye is used in the Soviet Army to refer to a sub-unit of a chast. It is a unit which cannot be fully identified numerically except by reference to a larger unit of which it is a component, e.g., battalions, companies, and platoons of a rifle regiment, etc. In this translation, the term podrazdeleniye has been translated as a sub-unit, or small unit.

b. Ploshchadka as used in this document refers to a section, comprised of a small detachment with specialist personnel assigned for the purpose of servicing tactical as well as service units. Personnel comprising the ploshchadka referred to herein would have had training in the effect of chemicals and atomic substances on personnel, animals, weapons, equipment, and installations, and processing for decontamination as well.

The Table of Contents is given at the end of the translation, as it appears in the original Russian text./

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PART III

Peculiarities of Combat Operations in Atomic Warfare

Introduction

The discovery of methods for the production of atomic energy in our country is the greatest achievement of Soviet science. The Soviet Government has a great interest in seeing to it that atomic energy is directed toward an increase in the growth of productive forces, toward an increase of national wealth, and toward the further improvement of the material and cultural level of the workers.

The creation in the Soviet Union of the first industrial atomic power station in the world is an indication of a great victory for Soviet science and technology, with respect to the peaceful utilization of atomic energy.

Imperialist states see in atomic energy nothing more than the means for aggression against other nations, primarily the peoples of the Soviet Union. In recognition of this fact, the Communist Party and the Soviet Government have taken steps to provide the Soviet Army with the weapons necessary for dealing an enemy a crushing blow.

Atomic weapons are more powerful than ordinary weapons, but there are reliable means of defense against even atomic weapons. The outcome of a war cannot be determined by atomic weapons alone. The outcome of a war will, in the final analysis, be determined by people, strong in spirit, who are armed by superior technology and who have mastered its use.

The troops of the Soviet Army are successfully learning to master the use of the war material entrusted to them, and they are becoming experts in their field. The task now before us is to acquaint ourselves with the military characteristics of atomic weapons and to study their use.

The successful combat training of the Soviet Army for atomic warfare requires the efforts not only of the officers but of the large body of sergeants.

This manual is intended as an aid to sergeants. It contains more complete data on atomic weapons and operations in atomic warfare than does the Handbook for Soldiers and Sergeants.

The first part of this manual deals with the structure of matter and with atomic energy, a knowledge of which is necessary for a proper understanding of the function of atomic weapons. It also includes a description of the destructive effects of atomic weapons.

Part II deals with specific measures for defense against atomic weapons.

Part III contains a description of the peculiarities of combat in atomic warfare, primarily for small units (podrazdeleniye). In addition, it deals with action to be taken in response to an atomic alert and, also, during and after in case of an atomic explosion. Part III also presents the additional duties of sergeants in atomic warfare.

PART I

Brief Data on Atomic Weapons

I. THE STRUCTURE OF MATTER AND THE PHYSICAL BASIS OF ATOMIC WEAPONS

1. The Structure of Matter

All the objects that surround us are composed of extremely small particles called atoms.

An atom is the smallest particle in a chemical element (of ordinary matter). Each of the 100 chemical elements known to us (hydrogen, helium, lithium, uranium, and others) is composed only of one type of atom. The types of atoms are differentiated by their dimensions, their weight, and their structure.

For a long time, scientists thought that the atom was indivisible. The very word "atom" means "indivisible" in Greek. However, later scientific developments revealed that the atom is a complex particle and is composed of a nucleus, which is surrounded by electrons.

Figure I

[Shows the structure of an atom of one of the chemical elements, helium.]

The nucleus of an atom has a positive electric charge, while the electrons carry negative charges. The total of all the electrons of an atom is equal to the positive charge of the nucleus, and the entire atom is, therefore, electrically neutral.

The atoms in various elements have various numbers of electrons, from one (in the hydrogen atom) to 100 (in the tsenturiya atom).

The electrons, circling around the nucleus, form an electronic shell around the atom. This shell is composed of one or more layers, which are at strictly determined distances from the nucleus. Each layer contains a set number of electrons.

Figure 2 shows the structure of the atoms of sodium and aluminum. The electron shells of these atoms consist of three layers. In the first layer of each atom there are two electrons, and in the second there are eight. The third layer of the sodium atom contains one electron, whereas the aluminum atom has three electrons in this layer. The figure with the plus sign (+) indicates the size of the positive electric charge of the nucleus of the atom.

Figure 2

[Structure of the atoms of sodium and aluminum.]

When two atoms interact (e.g., when they collide), one or more electrons in the outer layers of the electronic shell may be expelled. If even one electron is expelled from the shell, the atom assumes a positive electric charge. Such an atom is called a positive ion.

The electrons that have been expelled then attach themselves to other atoms. An atom that has acquired an additional electron is called a negative ion (figure 3).

The process of ion formation is called ionization. Some of the physical properties of matter are altered as a result of ionization. For instance, ionized air becomes a conductor of electricity. In live organisms, ionization leads to disruption of the vital activity of the cells.

Figure 3

/Normal and ionized atoms of the element lithium./

a) A lithium atom in its normal state (the number of positive charges is equal to the number of negative charges). b) A positive lithium ion; it has one positive charge more than it has negative charges (one of the electrons has been expelled from the shell). c) A negative lithium ion; there is one negative charge more than there are positive charges (acquisitive of one extra electron).

2. The Structure of the Atomic Nucleus

The atomic nucleus occupies an insignificantly small part of an atom. If one pictures an atom as a sphere 100 meters in diameter, the nucleus will be the size of a pellet about one millimeter in diameter.

The nuclei of all atoms are composed of protons and neutrons. Figure 4 shows, as an example, the structure of the lithium atom and its nucleus. As can be seen in the drawing, the nucleus of the lithium atom is composed of three protons and four neutrons.

Figure 4

/Lithium atom/

A proton is a particle with a positive electric charge. The weight of a proton is about 2,000 times greater than that of an electron, but the size of its charge is equal to that of an electron. A neutron is a particle without an electric charge. The weight of a neutron is approximately equal to the weight of a proton.

In comparing the weights of electrons with the weights of protons and neutrons, it becomes evident that almost the entire matter is concentrated in the nucleus.

The nuclei of the atoms of all chemical elements contain a strictly determined number of protons. If the number of protons in the nucleus is altered, all of the chemical and physical properties of the atom are altered, i. e., the resulting atom becomes an atom of another chemical element. In an atom that has not been ionized, the number of protons is exactly equal to the number of electrons (see figure 4).

Most chemical elements contain a mixture of atoms, which have the same number ofprotons in the nucleus but a diverse number of neutrons. Such diversities in the atoms of one and the same chemical element are called isotopes.

For instance, the nuclei of most hydrogen atoms consist of one proton. However, there is a kind of hydrogen (it is rarely encountered in nature) the atoms of which have nuclei with one proton and one neutron. This kind of hydrogen is called deuterium. The union of two deuterium atoms with one oxygen atom produces heavy water. It is even possible to produce hydrogen with nuclei of atoms which have one proton and two neutrons. Such hydrogen is called tritium.

Thus, hydrogen has three isotopes (figure 5). Deuterium and tritium can be used as the charge for a hydrogen bomb.

Some elements have a larger number of isotopes. Uranium, for example, has eleven isotopes, two of them, Uranium 233 and Uranium 235,[1] can be used as the charge for an atomic bomb.

All isotopes of a given element have the same chemical properties, but they differ in their weight.

Since all protons have a positive electric charge (i.e., they have similar charges) and since objects with like charges, as is known, repel each other, one would expect a nucleus with more than one proton to fly apart. However, this does not occur. On the contrary, the nuclei of atoms are usually very stable, and it is extremely difficult to split them. The stability of nuclei is a result of the fact that, in addition to the electrical forces of repulsion among the protons, there is a strong cohesive force among all the particles which make up the nucleus. These forces operate only within extremely short distances. They are strong enough to counteract the electrical forces of repulsion.

Figure 5

/Atoms of hydrogen isotopes./

Nuclear stability varies from one chemical element to another, as well as in the isotopes of a single chemical element. The less stable nuclei of some chemical elements sometimes convert spontaneously into more stable nuclei of atoms of other chemical elements without outside influence.

3. Radioactivity, Nuclear Reactions, and Atomic Energy

The conversion of less stable atomic nuclei into more stable nuclei is accompanied by an emission of radioactive radiation.

Substances that are capable of radioactive radiation are called radioactive, and the very phenomenon of radiation emission is called radioactivity.

Radium, uranium, and thorium are natural radioactive elements, while the isotopes of carbon, sodium, and phosphorus are artificially produced radioactive elements.

1. The figure 235 means that there are 235 protons and neutrons in the atomic nucleus of uranium (92 protons and 143 neutrons).

Natural radioactivity was first discovered in uranium salt in 1896; later it was discovered in radium. Artifically produced radioactivity was discovered in 1934. At present, there are several hundred artificially produced radioactive isotopes, but at that time only fifteen natural radioactive elements were known.

Atomic radiation is invisible. It has a number of interesting and important characteristics. For example, atomic radiation is capable of producing ionization.

The ionization capabilities of the atomic radiation of some elements, such as radium, are very great. This makes it possible to detect minute quantities of radium. If a few milligrams of radium were distributed equally among all the inhabitants of the earth, it would still be possible to detect radium in each person.

The radiation from radium produces various changes in the substances near it. For instance, optical glass assumes various colors, while the surface of a diamond is converted into graphite. Radium rays separate water into its component parts, hydrogen and oxygen.

Figure 6

/The division of the radiation from radium into alpha, beta, and gamma rays./

Radium produces various kinds of radiation. If a narrow beam of rays from radium passes between the poles of a strong magnet, the beam divides into three beams, one which goes to the left, the second straight ahead, and the third to the right (figure 6).

Those rays that go straight ahead are named gamma rays. The magnetic field does not influence them. Those rays that are sharply deflected by the magnetic field in the direction in which negatively charged particles are deflected are called beta rays. Those rays that go in the opposite direction are called alpha rays.[2]

The disintegration of other radioactive substances does not necessarily produce all three types of ray.

Now let us examine the nature of these rays.

Alpha rays are a stream of positively charged particles. Each of these particles is composed of two protons and two neutrons, i.e., it is nothing other than the nucleus of the helium atom.

The speed of alpha particles varies between 10,000 and 20,000 kilometers a second. At this speed, it would take less than one minute to reach the moon from here. While traveling, the alpha particles collide a great number of times with the atoms in the surrounding media, so that their speed is quickly reduced. Even in the air, the movement of alpha particles is reduced so rapidly that it is impossible for them to travel more than nine centimeters. At the end of its path, the alpha particle, having annexed free electrons, is converted into helium.

2. Alpha, beta, and gamma are the first three letters of the Greek alphabet (α, β, γ).

When alpha particles are released, the nucleus of the atom is diminished by two protons and two neutrons, i.e., it becomes the nucleus of an atom of another chemical element. For instance, when the radium atom releases alpha particles, it is converted into an atom of the gas radon (figure 7).

Figure 7

[Disintegration of the nucleus of a radium atom as a result of the release of an alpha particle (alpha disintegration).]

Beta rays are a stream of negatively charged particles, electrons, which are released by the nuclei of atoms when neutrons are changed into protons [sic].

When the nucleus of an atom releases beta particles, the number of protons in the nucleus is increased, and the number of neutrons is reduced by one. As a result of this process, another chemical element is formed. For example, when the radioactive isotope of gold releases a beta particle, it is converted into mercury (figure 8).

Figure 8

[Disintegration of the nucleus of a radioactive gold atom with the release of a beta particle (beta disintegration).]

The speed of beta particles varies greatly; some of them travel at almost the speed of light (300,000 kilometers per second). The fastest beta particles do not travel farther than 1.5 kilometers through the air.

Gamma rays, like X-rays, are electro-magnetic radiation. They travel at the speed of light.

These three types of rays are absorbed in various ways by matter (air, earth, metal, wood, etc.). If the lead box in which the radium is located is covered with an aluminum plate .02 millimeters thick, there will be no alpha particles in the issuing beam, because they will be completely held back by the aluminum sheet (figure 9). Alpha particles are also completely absorbed by clothing. In order to hold back the beta rays, the box would have to be covered with a sheet of aluminum three millimeters thick. To achieve almost complete absorption of the gamma rays, one would need an aluminum layer 100 to 120 centimeters thick.

Every radioactive substance (whether natural or artificially produced) disintegrates at a set speed. Some radioactive substances disintegrate very fast (in a split second), while others disintegrate very slowly (in millions of years). The speed of radioactive disintegration cannot be increased or reduced by any means.

The energy imprisoned in the nucleus is released during the disintegration of radioactive substances. This energy is called nuclear or atomic energy. It is carried into space by radioactive radiation.

Figure 9

[Absorption of alpha, beta, and gamma rays by aluminum.]

Natural radioactive disintegration takes place gradually, and the amount of atomic energy released in a given period of time is, therefore, comparatively small. For example, the amount of atomic energy released by one gram of radium in one hour is only enough to heat 100 grams of water 1.36 degrees (centigrade).

In 1939, a special type of nuclear conversion was discovered, the division of the nuclei of several heavy elements (uranium, plutonium).

It was learned that, under bombardment by neutrons of a certain speed, the atomic nuclei of heavy elements (uranium, plutonium) undergo a nuclear reaction: The nuclei of uranium and plutonuim atoms split into fragments (splinters) which are radioactive nuclei of the atoms of other, lighter elements (figure 10).

Figure 10

/Fission of a heavy nucleus, resulting in two smaller nuclei (fragments)./

The fission of an atomic nucleus may release an enormous amount of energy in a brief period of time. The fission of all the nuclei in one gram of uranium is accompanied by the release of enough energy to heat 100 tons of water to the boiling point.

The fission of each nucleus of a uranium or plutonium atom is accompanied by the release of two or three neutrons, which, under certain conditions, can bring about the fission of the nuclei of other atoms. This leads to a self-generated (chain) nuclear reaction (figure 11).

Figure 11

/The development of a nuclear chain reaction, with two or three neutrons effecting the fission of succeeding nuclei./

The fission of uranium or plutonium nuclei is now being used, for example, to produce energy for atomic-powered electric stations.

A self-generated nuclear reaction may be of an explosive nature. Such a reaction is called an atomic explosion. In this case, an enormous amount of atomic energy is released in a very short period of time. For instance, the fission of all the atomic nuclei in one kilogram of uranium 235 releases, in a millionth of a second, an amount of energy approximately equal to that produced by the explosion of 20,000 tons of TNT. Nuclear reaction of an explosive nature furnishes the source of energy for atomic bombs.

II. TYPES OF ATOMIC WEAPONS

Weapons with a destructive power based on the utilization of atomic (intranuclear) energy are called atomic weapons.

There are two types of atomic weapons: Atomic weapons that produce explosions, and combat radioactive substances (BRV - boyevyye radioaktivnyye veshchestva).

The explosive type of atomic weapon is based on the utilization of atomic energy, instantaneously released by a chain nuclear reaction of an explosive nature. This type of weapon is intended for the annihilation of personnel, the destruction of fortifications, and the destruction or damaging of war material. The explosive atomic weapon is generally known in the form of the atom bomb. This type of weapon can also be ulitized in the form of artillery shells, torpedoes, rockets, and guided missiles.

The destructive effect of atomic bombs, torpedoes, missiles, etc., is the same. The only possible difference lies in the force of the explosion.

Combat radioactive substance (BRV) is the name given to substances specially prepared for use in combat and containing radioactive atoms. The destructive effect of these substances is based on the harmful effect exercised by radioactive radiation on live organisms. These substances can be used, in an attack against personnel, to contaminate an area, various objects, and the air.

1. Explosive Atomic Weapons

Structure of the Atomic Bomb

The basic component parts of the atomic bomb and of other explosive atomic weapons are the atomic charge, the detonator, and the casing (the hull of the bomb).

Uranium 235 or plutonium 239 are used as charges in atomic bombs. It is not possible to produce an atomic explosion with an arbitrary amount of uranium or plutonium. A certain minimum quantity of uranium or plutonium is needed to produce an explosion; this amount is called the critical mass. The magnitude of the critical mass of the charge depends on its (the charge) form, the material of the casing, and the construction of the atomic bomb. The amount of the atomic charge should not be equal to or higher than the critical mass, because a chain nuclear reaction might occur (i.e., an atomic explosion might take place) under the influence of chance neutrons, which are always present in the air. For this reason, up to the time that an atomic charge is used as an explosive, it must be divided into several parts, each of which is smaller than the critical mass.

The sketch of the structure of an atomic bomb (figure 12) shows the atomic charge divided into two parts.

Figure 12

/Diagram of atomic bomb with its charge divided into two parts.
A shows the bomb before the explosion.
B shows the two atomic charges drawing together./

In order to bring about an atomic explosion, the two sections of the charge must be brought together rapidly. The completeness of the chain nuclear reaction and, consequently, the force of the explosion depend on the speed with which the two parts are brought together.

Figure 13 shows an atom bomb with its charge divided into three parts. In this bomb, the parts of the charge are united by the explosion of the cumulative charges of conventional explosive material. As they approach each other along the cylindrical channel from which the air has been expelled, the moving parts of the atomic charge pick up sources of neutrons along their path. The sources of neutrons positively guarantee that the bomb will explode at a given moment, and they serve to increase the number of nuclei of atoms in the uranium (or plutonium) that will fission.

The neutron deflector plays a large part in the development of a nuclear chain reaction. The deflector returns to the area of the nuclear reaction neutrons that escape the limits of the charge. The bomb casing hinders the dispersal of the atomic charge, which makes possible a more complete nuclear reaction and, consequently, increases the force of the atomic explosion. The casing also deflects the neutrons into the area of the reaction.

Figure 13

/Diagram of an atom bomb with its charge divided into three sections.
A shows the bomb before the explosion.
B shows the bomb as the sections of atomic charge approach each other./

The premature dispersal of the atomic charge at the time of the explosion is also prevented by the pressure that results from the explosion of the conventional explosive material in the spherical layer.

Despite the fact that the casing of an atomic bomb is made of the kind of material that will provide it with adequate stability, part of the material of the atomic charge escapes the chain reaction and flies apart with the casing.

Types of Atomic Explosions

An atomic explosion can take place in the air, on the surface of the ground, or below the surface of the ground (or water). We, therefore, distinguish between air, surface, and underground (or underwater) explosions.

An explosion in the air is one that takes place at a height of several hundred meters above the ground (or water). The point on the ground above which the atomic explosion takes place is called the epicenter (figure 14).

Figure 14

/Epicenter of atomic explosion./

A surface explosion is one that takes place on the surface of the ground or just a little above the ground.

An underground (underwater) explosion is an atomic explosion that occurs under the ground (or water).

Figure 15

[Types of atomic explosions]

External Appearances of an Atomic Explosion

An atomic blast in the air produces a blinding flash (figure 16), which lights up the sky and the ground below for a distance of tens of kilometers. The flash is followed by a ball of fire.

The ball of fire grows rapidly and cools; its light becomes less intense, and after a while it disappears.

Figure 16

[The flash from an atomic blast in the air]

The time lapse between the first appearance of the ball of fire and its extinction is only a few seconds.

Following the extinction of the ball of fire, there appears a swirling cloud that grows rapidly in size and climbs upward. It is followed, from the ground, by a column of dust, which gives the cloud from an atomic blast the shape of a mushroom (figure 17). The cloud attains a height of ten kilometers or more. In time, the cloud loses the mushroom shape and disperses.

Figure 17

[The mushroom-shaped cloud of an atomic blast]

In addition to the column of dust, the blast also raises clouds of dust from the ground (figure 17), which remain in the air from ten to thirty minutes.

When an atomic explosion takes place on the surface of the earth, instead of a ball of fire, a fiery hemisphere is formed. The cloud following a surface explosion also has the shape of a mushroom.

The outward appearance of an underwater blast depends on the depth at which the explosion takes place and on the depth of the water.

If the explosion occurs not very far below the surface of the water, a column of water rises to a height of more than a kilometer from the surface. A cloud forms at the top of this column and grows rapidly, attaining a diameter of several kilometers (figure 18).

Several seconds after the the underwater explosion, the water begins to fall out of the column. When this happens, a wave composed of small drops (spray) forms at the base of the column.

An underwater explosion is also accompanied by the appearance of ordinary waves on the surface of the water. Close to the site of the blast, these waves may attain a height of from 20 to 30 meters. The waves become smaller in proportion to their distance from the explosion.

If the underwater blast occurs in shallow water, the blast makes a large crater in the floor. In this case, a considerable amount of earth as well as water is lifted into the air.

An atomic blast is accompanied by a very loud and piercing noise, which can be heard for tens of kilometers.

Figure 18

[Outward appearance of an underwater atomic explosion.]

Destructive Effects of an Atomic Blast

As a result of the release of an enormous amount of energy by the atomic explosion, the temperature in the center of the blast rises to millions of degrees. It is this extremely high temperature that leads to the formation of the ball of fire, which is the source of the strong flash of light (svetovoye izlucheniye).

The heated gases that compose the ball of fire spread rapidly, pushing away the surrounding air and compressing it. This is the cause of the shock wave.

A blast of an atomic bomb is accompanied by invisible radioactive rays, which are called penetrative radiation.

In addition, in the area of the explosion and along the path traveled by the atomic cloud, there is a fall-out of radioactive substances that produces radioactive contamination of the air and of the area.

In the area surrounding the site of the blast, contamination may also result from the fact that, under the action of the stream of neutrons from the blast, some of the non-radioactive substances that compose the top layer of soil may become radioactive.

The shock wave, the flash of light, penetrative radiation, and radioactive contamination of the area are the destructive factors of an atomic blast.

Shock Wave

The shock wave is the principal destructive force of an atomic blast. It consists of highly compressed air, which spreads out in all directions, at high speed, from the center of the blast. The compression is transferred rapidly from one layer of air to another.

When the shock wave reaches a given point in the air, for instance Point A (figure 19), the temperature and the pressure at this point rise instantly, and the air begins to move in the direction in which the shock wave is spreading. In the succeeding moments, when the front of the shock wave (its front edge) passes this point, its pressure there gradually subsides and eventually becomes equal to atomspheric pressure.

Later on, the pressure drops to below that of the atmosphere (rarefaction sets in). When this happens, the air at Point A begins to move in the opposite direction from which the shock wave is spreading.

The movement of the air ceases as soon as the action of the reduced pressure at Point A comes to an end.

Thus, the shock wave is composed of a pressure zone (the zone in which the pressure is greater than in the atmosphere) and of a zone of rarefaction (the zone in which the pressure is lower than that of the atomosphere).

The air pressure at the front of the shock wave near the center of the atomic blast goes up to many thousands of atmospheres.

The pressure at the outer limits of the shock wave drops rapidly and continuously, in proportion to the distance from the center of the blast.

The speed of the spread of the shock wave depends on the pressure at the front of the shock wave. Near the center of the blast, the speed at which the shock wave spreads is several times greater than the speed at which sound travels through the air.[3] However, as the distance from the site of the blast increases, the speed at which the wave spreads drops rapidly. The shock wave travels 1,000 meters in two seconds, 2,000 meters in five seconds, and 3,000 meters in eight seconds (figure 20). During this time, a person who had seen the flash could seek cover, thus reducing the probability of being struck by the shock wave and, perhaps, escaping it altogether.

Figure 19

[Diagram showing the action of the shock wave of an atomic blast.

A - The front of the shock wave has not reached point a; the pressure at this point is normal. B - The front of the shock wave has reached point a; the pressure has risen sharply. C - The front of the shock wave has passed point a; a tree standing at this point bends in the direction in which the shock wave is spreading; the pressure at point a has dropped somewhat. D - The pressure at point a is normal; the tree has straightened up. E - Point a is within the zone of rarefaction, where air pressure is below that of the atmosphere; the air has started to move in the opposite direction, and the tree bends with it. F - The shock wave has passed point a; air pressure is normal.]

The shock wave is capable of killing people and of destroying or damaging buildings, war material, and property. Destruction and damage may be brought about as either a direct or an indirect result of the action of the shock wave. Indirect action consists of destruction and damage caused by flying debris and fragments from buildings and by flying stones, clumps of earth, etc.

Figure 20

[Speed of spread of the shock wave.]

3. Sound travels through the air at a rate of 340 meters per second.

The shock wave can also cause destruction in enclosed premises, which it reaches through cracks and other openings.

The degree of injury to persons and of damage to buildings and war material depends primarily on the distance from the center of the blast; the greater the distance from the center of the blast, the less is the destructive effect of the shock wave. The extent of injury to persons and of damage to military equipment also depends on their location when they are struck by the shock wave, on the type of locality, and on the availability of shelter. The presence of protective structures reduces the radius of the area of destruction by 150 to 300 percent. The armor on combat vehicles also reduces the radius of destruction. Ground features and rugged terrain lessen the destructive effects of the shock wave.

In populated places, the shock wave may cause conflagrations as the result of damage to stoves and to power and gas lines. The fires, in turn, may cause injury to people and damage or destruction to military equipment and property.

When an explosion takes place underground, a shock wave is formed underground; if it is underwater, the shock wave is formed in the water. In these cases, part of the energy goes to form a shock wave in the air as well.

The Flash of Light

The flash of light brought about by an atomic blast lasts only several seconds.

The injurious effect of the flash decreases in proportion to the distance from the site of the explosion, as a consequence of the dispersal of energy over a larger area and of the absorption and diffusion of the light. The absorption of light is especially great in a fog, rainfall, or snowfall.

The light rays do not pass through opaque material. Therefore, any shield (a wall, a closed building, armor, canvas, a dense forest) will furnish shade and protection from the direct effects of the light and prevent burns (figure 21).

Figure 21

[The shade thrown by the hill, the ravine, the house, or the tree serve as protection from being burned by the flash of light.]

In the case of underwater and underground explosions, the danger from the flash of light is negligible.

In an atomic explosion that takes place on the surface, the effect of the light flash is less over long distances than it is in an air explosion, because about half the energy from the light flash is expended in the fusion of the earth near the site of the explosion.

Despite the shortness of its duration, the light flash can cause burns on exposed portions of the bodies (face, neck, hands) of unprotected persons. Sometimes it causes temporary blindness.

The injurious effect of the light flash to the eyes is considerably greater at night than it is in the daytime.

The burns caused by the light flash from an atomic blast are in no way different from ordinary burns caused by fire or boiling water. There are first, second, and third degree burns.

In a first degree burn, the skin is reddened and there is swelling. In a second degree burn, blisters appear on the skin. A third degree burn is characterized by sores.

The degree of the burn depends on the length of exposure to the flash and on the distance from the blast. Persons in an open area can be injured by the flash of light, even if they are at a distance where the effects of penetrative radiation and of shock wave are slight.

The degree of injury to an organism from the flash of light depends not only on the severity of the burns, but also on the size of the area of exposed skin.

Ordinary clothing provides considerable protection and may completely prevent burns.

The color of the clothing, the thickness of the material, and its tightness have some influence on the severity of the burns suffered on covered portions of the body. A person dressed in loosely fitting clothes of a light shade will receive fewer burns on the covered portions of his body than a person dressed in tightly fitting clothes of a dark color.

Under the effect of the light flash, the surfaces of various objects may become charred, or they may melt or burst into flames. The flash may set fire to uncovered war material, paint, canvas, and tents; it may burn or char uncovered wooden parts of weapons, military equipment, and buildings. Close to the center of the blast, metal may become molten.

The flash may cause fires in populated places, in forests, and in the steppes.

Penetrative Radiation

Penetrative radiation consists of a stream of gamma rays and neutrons, which are released by the atomic explosion.

The primary source of gamma rays during an atomic explosion is the radioactive fragments produced by the fission of the nuclei of the uranium atoms, which are present in the area of the explosion and in the radioactive cloud.

The effect of the gamma rays decreases rapidly with time. In general, gamma rays are not active for more than ten or fifteen seconds.

Gamma rays and neutrons are capable of penetrating materials of considerable thickness.

When a gamma ray passes through a substance, its force is diminished in proportion to the density of the material. In the air, for example, gamma rays travel many hundreds of meters, but they cannot move more than a few centimeters through lead.

A stream of gamma rays is cut in half when it passes through a layer of earth 14 cm thick, a layer of wood 25 cm thick, or an armor plate 2.8 cm thick (figure 22).

The source of neutrons in an atomic explosion is the fissioned nuclei. During an explosion, the stream of neutrons is active for a fraction of a second and travels hundreds of meters through the air.

A beam of neutrons is weakened when it passes through various substances in the same way that the gamma rays are weakened. The strength of a beam of neutrons is most effectively reduced by substances containing light elements such as hydrogen, carbon, and others. The force of a neutron beam is efficiently reduced by damp earth, wood, concrete, asphalt, and water.

Non-radioactive substances in the earth (particularly in swampy, sandy, saline, or clayey ground) become radioactive under the effect of neutrons. This is also true of some metals. Such radioactive substances lose their radioactivity within a few hours.

The effect of penetrative radiation is negligible in the case of underwater and underground explosions. This is because, in an underwater and underground explosion, almost the entire stream of gamma rays and of neutrons is absorbed by the medium surrounding the blast (water or earth).

Penetrative radiation has an injurious effect on the organisms of humans and animals. The radiation may produce a disorder known as radiation sickness.

Radiation sickness develops gradually. The course of the disease varies between one individual and another and depends on the individual organism.

The severity of the radiation sickness depends for the most part on the amount of radiation to which the organism was exposed. The amount of radiation is measured in roentgens. A dose of radiation of between 100 and 200 roentgens may cause only slight illness. A dose of over 200 roentgens is more serious. In this case, the illness will be characterized by headache, a rise in temperature, and gastric disturbances.

Figure 22

/Reduction of the dose of penetrative radiation by protective layers./

The dose of radiation that a person may receive as the result of an atomic explosion depends primarily on his distance from the site of the blast; it also depends on what protection he has. There is a sharp decrease in the amount of radiation (gamma rays and neutrons) as the distance from the explosion increases.

Persons who are in a shelter at the time of the explosion will receive a smaller dose of radiation than persons who are out in the open and are at the same distance from the blast. Trenches, the roofs and walls of defensive construction, as well as armor of tanks and self-propelled artillery guns greatly reduce the effect of penetrative radiation.

Penetrative radiation has no harmful effect on some things, including combat equipment. However, the glass of optical instruments (binoculars, panoramic sights, periscopes, et al.) turns dark when it is exposed to a considerable dose of radiation. Photographic material, (such as film and paper, is damaged by the light if it is exposed to as small a dose as two or three roentgens.

Radioactive Contamination of Ground and Air in an Atomic Explosion

The air and the terrain in the path of an atomic explosion and along the path of the atomic cloud, as well as equipment, personnel, and animals not under shelter, may be contaminated by radioactive substances.

The radioactive substances that contaminate the terrain following an atomic blast are composed of products of the fission of the nuclei of uranium (plutonium) atoms; of artificially produced radioactive substances formed at the time of the explosion from non-radioactive substanced found in the composition of the bomb casing; of artificially produced radioactive substances from the soil and other materials; and of parts of the atomic charge that escaped the reaction at the time of the explosion.

The degree to which a locality is contaminated at the time of an atomic blast and the size of the contaminated area depend on the type of explosion (air, surface, underground), on the size of the charge in the bomb, and on meteorological conditions and the character of the terrain and soil.

If the explosion takes place in the air, most of the radioactive products rise with the cloud, and the area is not badly contaminated.

Near the epicenter of the explosion, contamination is the result primarily of radioactivity in the soil, which is produced by the action of the neutrons. Since the radioactive substances in the soil lose their radioactivity comparatively fast, serious contamination is present only for the first few hours after the blast.

When the atomic explosion takes place on the surface of the ground, a large part of the radioactive products is mixed with the soil and scattered by the shock wave. Small particles of soil are carried up into the radioactive cloud by the rising air currents. As the cloud rises, some of the radioactive products of the blast settle on the larger dust particles and dross and fall out onto the ground near the site of the explosion, thus contributing to the radioactive contamination in the area of the explosion.

The fall-out of radioactive substances, together with particles of soil and dust, also continues along the path traveled by the cloud. This leads to the formation of a radioactive trail. Along most of this trail, the contamination is not severe; it is only at the points nearest the site of the blast that parts of the trail may be severely contaminated.

Rain and snowfall contribute to the rapid fall-out of radioactive substances from the cloud. It may happen that the area nearest to the point of the explosion will become much more acutely contaminated, while the contamination of the air is greatly reduced.

A heavy snowfall following the explosion may bring about some decrease in the intensity of the radioactive radiation, if a sufficiently protective layer of snow covers the radioactive substances that have fallen on the area.

Radioactive particles are more readily retained on rough or wet surfaces.

Surfaces of objects turned toward the direction of the blast become more severely contaminated than surfaces which are facing in the other direction. If a structure has cracks, doors, or other openings in it, the surfaces of objects in the interior can become contaminated.

The direction and the force of the wind have a considerable influence on the degree of contamination of various parts of a locality and of the surfaces of objects therein.

The contamination of the air is worse in areas where there is little vegetation, because of the dust that is blown up.

When an atomic explosion occurs underwater, a large stratocumulus cloud, which releases radioactive rain, is formed. A large part of the radioactive substances that are formed in an underwater blast is retained in the water, which brings about extreme contamination of the water.

If an explosion takes place close to shore, the shore may become contaminated by radioactive substances, as a result of both the radioactive rain and the radioactive water thrown onto the shore.

People and animals may receive injuries if radioactive substances come into contact with their skin or the mucous membrane of the eyes, nose, or mouth within the organism, or if they are exposed to a beam of beta particles or, particularly, gamma rays.

If radioactive particles which have fallen onto the skin or which have come into contact with the mucous membranes of the eyes, nose, or mouth are not removed in time, they may cause sores and inflammation.

When large doses of radiation are received or when radioactive substances have been taken internally, radiation sickness may result.

Radioactive substances are not injurious to combat equipment. However, in order to avoid injury to personnel by contact with contaminated equipment, equipment must be freed from radioactive substances by mechanical means. Various chemicals can be used for this purpose, a weak solution of acids, alkali, alcohol, benzine, etc.

One of the peculiarities of radioactive substances is that they may be free of any particular odor, color, or other external characteristic that identifies many toxic substances used in combat. Radioactive contamination is revealed by special instruments called dosimeters (dozimetricheskiye pribory).

The degree of radioactive contamination of an area is characterized by the strength of the dosage of gamma and beta radiation on the surface of the ground; it is measured in roentgens per hour.

The radioactive products of an atomic blast fall from the cloud over a large area. However, the radioactive contamination of the larger part of most of this area does not present a serious hazard to ground forces.

The length of time during which it is safe for personnel to remain in a contaminated area without injury to their health depends on the degree of radioactivity present.

The radioactive contamination of an area diminishes continually, because the radioactive substances disintegrate, because these substances are blown away from the surface of the soil by the wind and washed away by the rain, and because they penetrate into the soil.

Combat Radioactive Substances (BRV)

Specially prepared radioactive substances, called combat radioactive substances (BRV), can be used in liquid or powder form or as smoke for the purpose of contaminating the terrain, the air, water, produce, weapons, war material, etc. Radioactive substances may also be mixed with poisonous substances.

The injurious effect of combat radioactive substances does not differ from the injurious effect of the radioactive substances released from the blast of an atomic bomb.

The contamination of the terrain and of the air with radioactive substances can be brought about by using guided missiles (reaktivnyye snaryady), rockets, aerial bombs, artillery shells, and mines charged with these substances.

PART II

Measures for Antiatomic Defense

I. GENERAL REMARKS

The possibility of carrying out atomic strikes by the enemy makes it necessary to adopt special measures for the disruption of an atomic attack and to organize antiatomic defense.

The destruction of atomic weapons and the disruption of an atomic attack by the enemy are effected according to plans worked out by the supreme command. Aviation, artillery, and other means are brought into use for this purpose.

One of the principal means used in atomic attack is airplanes (atomic bomb carriers); therefore, the entire system of antiaircraft defense plays an important part in warding off atomic strikes by the enemy.

A strict observance of camouflage, a skillful use of the cover of night for combat and marches, and also skillful use of bad (flying) weather are important for successful combat operations in atomic warfare.

Antiatomic defense is one of the most important types of combat protection of troops. These defenses are organized and established by order of the senior officers, but every commander must independently take all antiatomic defense measures within his province, regardless of the situation.

Antiatomic defense measures are executed uninterruptedly not only during all types of combat, but also when the troops are well in the rear. Their purpose is to protect the troops from the direct effect of atomic weapons and to maintain their combat preparedness.

Antiatomic defense includes:

- Warning to the troops of the danger of an atomic attack by the enemy;

- Engineer organization of the ground with respect to antiatomic defense;

- Continual radiation reconnaissance and the observance of precautionary measures against injury by radioactive substances;

- The execution of measures to eradicate the consequences of an atomic attack.

The purpose of a warning to the troops is to enable them to take steps in time to ward off, and defend themselves against, the destructive effects of atomic weapons. Personnel are warned by a predetermined signal transmitted by radio and telephone and quickly passed on by aural or visual signals.

The purpose of the engineer preparation of the ground in antiatomic defense is to reduce sharply, or to eliminate completely, the effect on personnel, equipment, and combat materiel of the destructive factors of an atomic explosion, i.e., shock wave, penetrative radiation, light flash, and radioactive contamination.

Radiation reconnaissance must reveal in time the presence of radioactive substances which have dropped on the area following an atomic explosion or which have been employed directly by the enemy, determine the degree of radiation, mark off the contaminated areas, seek out detours around those areas, and warn the troops promptly to take precautionary measures against radioactive substances.

Dosimeters are used to protect personnel from exposure in excess of the safe dosage.

The purpose of eradicating the consequences of an atomic attack is to restore rapidly combat preparedness of the troops. This eradication includes such measures as life saving, extinguishing of fires, reconstruction of ruined or damaged defense works and communication lines, medical treatment for men and animals, and decontamination of clothing, equipment, weapons, combat materiel, and rations.

II. DEFENSIVE WORKS

1. <u>Trenches and Communication Trenches</u>

In atomic warfare, as in conventional warfare, trenches and communication trenches are the basic part of engineer ground organization. In an atomic attack by the enemy, they ensure significant reduction in losses resulting from the shock wave, the light flash, and penetrative radiation.

Large numbers of recesses, slits, refuges, and overhead covers for the protection of personnel and equipment must be built in the trenches and communication trenches.

Sections of both types of trench are provided with overhead cover in order to increase their protective efficiency. Rifle squads usually build one covered section ten to twelve meters long.

At the first opportunity, both types of trenches are excavated to a depth of 1.5 meters; covered sections of trench and points where recesses, blinds, and refuges are located are made up to 1.8 meters deep. The trenches must be laid out so that there are no sharp angles at the breaks, because, otherwise, they are easily destroyed by the shock wave in the area of the breaks.

Trenches without parapets or rear traverses do not provide adequate protection.

The trenches and communication trenches built in soft ground must have revetted slopes to provide them with greater resistance to the shock wave. The covered sections of the trenches and the entrances to the cover also have revetted slopes. Figure 23 shows a section of trench equipped for antiatomic defense.

Figure 23

/Section of trench equipped for antiatomic defense./

Brushwood or cane mats (figure 24), poles, boards, slabs, etc., are widely used for the revetment of slopes. The most stable of these materials are mats made of brushwood or cane.

If the revetment of the slopes is to be made of poles and boards, the distance between the uprights is one meter; the length of the guy wires is two and a half to three meters. The uprights should be ten to twelve centimeters in diameter, and they must be driven at least fifty centimeters into the ground. The anchor pickets for the guys must be made of poles six to eight centimeters in diameter, and they must be driven in to a depth of at least fifty centimeters.

Figure 24

/The construction of revetments from brushwood or cane./

Cross bars made of two poles (skhvatka) and a beam (a piece of a pole), placed in such a manner as to push against the uprights, can be used in place of guy wires. If the trench is 1.8 meters deep or more, the uprights of the revetment must be secured both with poles (skhvatka) and with guy wires, especially if the trench has been dug in soft ground. If it is impossible to drive the stakes into the ground or if the ground is soft, the bottom ends of the uprights are reinforced by horizontal distance bars.

If the revetments are made of inflammable material, they must be covered with earth or clay in order to protect them from fire; in winter, they can be painted with whitewash. If long sections of the trench are revetted, firebreaks, one to two meters wide, must be made at intervals of 40 to 50 meters.

Figure 25

[Covered section of trench with covering and revetment.]

Logs with a diameter of 16 to 20 centimeters are used to cover trenches. The ends of the timbers are not placed on the ledgers, but directly on the ground. The timbers must project at least fifty centimeters. The revetment of the covered sections of the trenches must leave a space from ten to fifteen centimeters wide at the top. In the absence of logs for the covering, poles, boards, and brushwood fascines may be used. A layer of earth 40 to 50 centimeters deep is placed over the cover. In order to render the cover more resistant to the shock wave and to prevent it from standing out in the surroundings, it is made as level as possible with the ground. A section of trench with cover and revetment is shown in figure 25.

In the winter, it is advisable to build arched covers of snow or ice (figure 26) over the trenches.

Figure 26

[Arched trench cover made of fascines and snow.]

The platforms for machine guns and grenade throwers (figure 27) are built as under ordinary circumstances. Recesses, covered with strong shields, must be built near these platforms.

Observation pits (figure 28), unlike the usual type, are constructed with a covered entrance, and the hole is provided with a removable shield.

Blinds below the breastwork (figure 29) and recesses (figure 30) are constructed with flat or ribbed shields, ferroconcrete hoops, and whatever materials are at hand. Accesses to the blinds, or recesses, are equipped with strong shields or doors. Trenches adjoining the blinds are covered for a distance of from four to six meters on both sides of the access to the entrance. No less than eighty centimeters of earth must cover the blinds and the recesses.

Blinds below the breastwork are placed at a 90-degree angle to their entrance, or they are turned to face away from the axis of the entrance, so that persons will not be injured by wreckage from the protective doors or shields if the latter should be damaged by the shock wave.

Slit trenches are revetted, and they are usually covered. The entrances to slit trenches are covered with strong shields.

Figure 27

[Platform for machine gun or grenade thrower with a niche.]

Figure 28

[Observer's foxhole.]

COPY

Figure 29

[Sub-breastwork blind.]

Figure 30

[Sub-breastwork recess.]

2. Protective Works for Fire Weapons

Protective works for fire weapons (pits for machine guns, grenade launchers, mortars, guns, tank pits) are usually open structures.

Shelters with strongly built entrances are erected to protect personnel and fire weapons in these works.

Trench sides, particularly in soft ground, are faced with brushwood, poles, etc.

Machine guns pits are equipped with blinds for the protection of the machine gun crew.

Recesses covered with strong covers are built for machine guns and ammunition in the front slope of the pit.

In pits with a broad field of fire, two recesses may be built, one for the ammunition and one for the machine gun. Both recesses are covered with solidly made shields.

Gun pits may be dug so that the field of fire is narrow, broad, or circular. In pits for 57 mm, 85mm, and 100 mm guns, there must be built a platform for firing, one or two blinds for the gun crew, a shelter for the gun, ramps for dragging the gun to the fi'ing area and for removing it from its shelter, and recesses for the ammunition (figure 31).

Pits for guns of higher calibre are sunk farther into the ground (figure 32).

The framework of blinds used to cover gun crews is made of standard shields, logs, or materials at hand. Entrances to the blinds are equipped with doors.

The framework for gun covers is made of frames placed tightly against each other, and the entrance to the shelter is covered with a solidly built shield.

In order to reduce the size of the shelter, for the purpose of reducing the amount of work and the amount of material used, gun shelters can be built in such a manner that the front part of the plate and barrel protrude beyond the shelter. A trench is dug in the ramp for the spades. The shield that covers the entrance to the shelter is held up against the framework of the shelter by a timber that is, in turn, held by metal lugs. In order to facilitate the removal of the gun to the firing space, tracks made of boards or logs are laid along the ramp.

Mortar pits are sunk farther into the ground. The shelter for the mortar is built into the front slope of the pit. The entrance to the shelter is covered with a solid shield. The blind for the crew and the recesses for the ammunition are built into the sides of the trenches contiguous to the pit. The communication trenches are covered in sections near recesses and entrances to blinds.

Figure 31

[Pit for 57 mm or 85 mm gun with shelter and blind.]

When tanks and self-propelled artillery mounts are in position, pits are dug for them with a firing platform, shelter for the tanks, and blinds for the crew (figure 33).

In intermediate position areas and in concentration areas, shelters are built for the tanks and blinds for the crews (figure 34). A blind furnishes better protection for the crew from penetrative radiation than does tank armor.

A blind should have a cover made of logs, covered with a layer of earth at least one meter thick; the entrance to the blind is equipped with a solid protective door.

Closed structures for firing and observation provide better protection against atomic weapons than do pits. Their value lies in the fact that the covering lessens the effect of the shock wave and of penetrative radiation and provides complete protection against the light flash. Closed structures may be equipped with ventilation and filter systems for protection against radioactive substances.

The most vulnerable places in closed defensive field works are the entrances, gun ports, and ventilation ports. All openings in defensive structures must be provided with doors, shields, or other covers, for protection from the effect of the shock wave. The communication trench contiguous to the structure is covered with logs 16 to 20 cm in diameter under a layer of earth 40 to 50 cm thick; the slopes of these sections of communication trenches are revetted. The entrance to the structure is equipped with a protective door made of boards from five to seven centimeters thick.

Figure 32

[Pit for 122 mm and 152 mm howitzers for firing from position of cover.]

Figure 33

[Pit with shelter for medium tanks and self-propelled artillery mounts (SAU), with blind for the crew.]

Figure 34

[Shelter for tank or self-propelled artillery mount (SAU), with blind for the crew.]

Figure 35

[Dugout of light construction; accomodates ten persons.]

[The following are the identifying parts to Figure 35:

1. Apparatus to protect flue from shock wave.
2. Sheet steel, 2 mm thick.
3. Shock absorption chamber (volnogasitelnaya kamera).
4. Hermetic valve.
5. Sand.
6. Sand box (this is installed in clay).
7. Sheet steel, 1 mm thick.
8. Hermetic partition.
9. Lining, two layers of heavy paper.
10. Segmented board.
11. Plank.
12. Heavy protective door.
13. Heavy protective door.
14. Stove.
15. Not less than 150 cm.
16. Clay, 5 cm.
17. Hermetic partitions.
18. Air filter and ventilation apparatus.]

Figure 36

[Shelter for portable communications apparatus.
A - Recess. B - Sub-breastwork blind.]

In closed structures for observation purposes, apertures and ports are equipped with doors or removable shields; periscopes are provided to ensure observation during atomic attack.

The entrance to the structure is also equipped with a protective door.

Dugouts are the most satisfactory shelters for personnel, since they provide protection from the effects of atomic weapons.

Each dugout is provided with at least two entrances, one of which is kept for emergency use and is built to resemble a mine shaft. The main entrance is equipped with one or two air locks /tambur/.

The outer door of the air locks is a protective door, while the others are protective and hermetical, i.e., they are built in such a manner as to be airtight when closed. The construction of the air locks must be as solid as that of the framework of the shelter.

In order to prevent the shock wave from penetrating into the dugout, airtight apertures are equipped with anti-explosive valves or with gravel shock absorbers (volnogasiteli), which automatically close the aperture when the shock wave first hits. In the absence of such valves or shock absorbers, apertures for smoke and other outlets are covered manually with hermetic doors.

Communications equipment (portable radio sets, telephones) is kept in blinds or special shelters (figure 36). If time is lacking, slit trenches with recesses for personnel and material are built. Communications cables are laid at a depth of 20 to 25 cm.

3. Shelters for Transport Equipment, Equipment, Rations, and Horses

Ditches (figure 37) with ramps leading into them are built as shelters for automobiles and tractors; they are dug in such a manner as to be one-half meter deeper than the height of the vehicle.

In soft ground, these shelters are revetted.

Blinds are built for the drivers near the automobiles and tractors.

Figure 37

/Shelter for motor vehicles.
a - in flat ground; b - in inclined ground./

Technical equipment is placed, in its packing, in ditches up to 1.5 meters deep and 1.5 to 2 meters wide; the ditches are covered with a light covering or canvas.

Ammunition is placed in ravines, depressions, or specially dug shelters, at a distance from the storage places of other types of material. The distance between the shelters must be greater than under ordinary conditions, and the quantity of ammunition in each shelter must be less.

Fuels and lubricants are kept in ditches, one to 1.5 meters deep and 1.8 to 2.5 meters wide, with ramps leading into them (figure 38). Trench-like shelters can be built one meter deep; in this case, the barrels containing the fuels and lubricants are covered with a layer of earth five to ten centimeters deep.

It is advisable to bury large containers of fuel at a depth of no less than one to 1.5 meters. In order to obtain fuel from such large tanks, it is necessary to build a shaft over the hatch of these tanks.

Figure 38

[Shelter for fuels and lubricants.]

A dugout of light construction (figure 40) is built in the front slope of trenches for the storage of rations and clothing.

Figure 39

[Storage of large fuel tank.]

It is advisable to store field rations and forage in ditches, up to 1.5 meters deep, covered with flooring at the bottom and revetments at the side. Slit trenches are provided with light covers or canvas. If there is a considerable amount of ground water, the rations are stored in bundles on planking laid above ground (figure 41). In populated areas, rations are stored in masonry buildings (warehouses, dwellings, cellars).

Horses are sheltered in ditches up to two meters deep with ramps leading down into them.

Figure 40

[Storage dugout for rations and clothing.]

Figure 41

[Rations stored in bundles.]

4. Camouflage of Defensive Works

Camouflage assumes a role of particular importance under conditions in which atomic weapons are used.

The existing standard camouflage covers (tabelnyye maski) can be destroyed by the shock wave, or they may be set on fire by the light flash. In order to increase the resistance of standard covers to the effects of the shock wave of an atomic blast, the covers may be reinforced with additional inner and outer braces. The braces are more effective if the cover is attached to the ground.

The camouflage covers offer better resistance to the effects of the light flash if they are made of metal screens with metal filings woven into them or of weather proof (atmosferoustoychivaya) paper or cloth, which have been made fireproof (ognezashchitnyy sostav).

Standard camouflage equipment made of cotton mesh or cloth is made more resistant to the effects of the light flash if it is impregnated or painted in order to make it fire-resistant.

Camouflage made of materials at hand (mats made of cane, brushwood, straw, etc.) can be made more resistant to fire if it is soaked in or spread with watery clay.

III. PERSONAL PROTECTION EQUIPMENT USED IN CHEMICAL WARFARE

Personal protection equipment used in chemical warfare is used in avoiding contamination from radioactive substances.

Personal protective equipment is used to protect one from the effects of the light flash as well as from the effects of radioactive substances.

Gas masks provide adequate protection against the entry of radioactive substances into the respiratory passages.

The rules for the use of the gas mask as protection against radioactive substances are the same as those used for protection against chemical agents (boyevyye otravlyayushchiye veshchestva).

The protective cape is used to protect skin and clothing from radioactive substances.

The cape-matting (nakidka-podstil) is usedto protect clothing from contamination when passing through contaminated areas.

The protective stockings are worn for decontamination work and also when entering a contaminated area.

The protective gloves are worn as protection for the hands, especially when handling contaminated weapons (equipment) while carrying out decontamination work.

Figure 42

/Matting made from materials at hand:
A - from straw B - from brushwood/

The protective overalls or protective suit can be used whenever it is necessary to work in a contaminated area.

In the absence of standard individual means of antiatomic defense, one makes use of materials at hand for protective covering against radioactive substances.

Among the materials at hand which may be used to protect the respiratory passages are towels, handkershiefs, cotton, or gauze. One must fold the towel, handkerchief, or gauze into several layers, wet it in water, wear it as a mask over the nose and mouth, and breathe through it.

Mats made from materials on hand, e.g., straw on brushwood, can be used to protect clothing from contamination by radioactive substances (figure 42).

They are used as bedding in a contaminated area and in passing through a contaminated area not more than 500 m deep.

Shoes may be protected from radioactive substances by using sacking (meshkovina), worn-out cotton protective wrapping (nakidka) (figure 43), or shoe wraps (chuni) (figure 44). They are used in the same way as when passing through an area contaminated with chemical agents.

Figure 43

[How to wrap legs with strips from protective wrapping.]

Figure 44

[Shoe wraps.]

Horses may be protected from contamination by radioactive substances by use of gas masks and protective goggles designed for horses, as well as by the use of cloaks and leggings.

IV. RADIOLOGICAL RECONNAISSANCE

1. Organization of Radiological Reconnaissance

Radiological reconnaissance is undertaken in order to make it possible to take prompt measures to protect personnel from contamination by radioactive substances.

All units (chasti) and small units (podrazdeleniya), including those in the rear, are permanently, and in all circumstances, engaged in this reconnaissance.

It is the responsibility of all commanders and leaders of all grades up to and including company (battery) level, to organize radiological reconnaissance.

Radiological reconnaissance is carried out by organic (shtatnyye) chemical small units; if there are no such small units, it is carried out by sections, teams, or crews specially trained in chemical defense (khimizirovannyye).

Chemical and radiological reconnaissance are usually carried out together, but, depending on the circumstances, they may be performed separately.

Radiological reconnaissance (like chemical reconnaissance) is performed by patrols, observation posts, and separate chemical and dosimeter specialists (khimiki-dozimetristy).

At the time of reconnaissance, warning signs are used to mark the limits of contaminated zones, detours around them, and routes through them (figure 45).

An area is considered to be contaminated if the intensity of radiation exceeds 0.1 roentgen per hour; it is considered severely contaminated if the intensity is higher than 5 roentgens per hour; and it is considered dangerously contaminated if the radiation exceeds 100 roentgens per hour.

The results of the reconnaissance are reported to the commanders of the small units or to the persons who organized the reconnaissance; these persons determine the necessary measures to be taken for protection against contamination from radioactive substances.

2. Conduct of Radiological Reconnaissance

Chemical Observation Posts

For the purpose of carrying out radiological observation, chemical observation posts are set up in the area where their small units are stationed or in action. These observation posts are equipped both with instruments for chemical reconnaissance and with dosimeters.

A post is manned by two or three men, one of whom is put in command.

Figure 45

[Meaning of warning signs placed in areas contaminated by radioactive substances.]

The chemical observation post conducts radiological reconnaissance with dosimeters at regular and irregular intervals. Periodic surveys are made of the assigned area within a radius of 600 meters. The post also maintains uninterrupted observation of the direction of travel of the atomic cloud produced by the blast.

Irregular readings of the instruments are taken after an enemy plane has flown past, after an air attack or an artillery barrage, during the laying of a smoke screen by the enemy, and when the atomic cloud is moving toward the location of the small unit.

Radiological observation is carried out on the post by observers on a regular schedule. Surveys of the area, following an air or artillery attack, are performed by a non-scheduled (svobodnyy) observer. The observer in command (starshiy nablyudatel) keeps under observation the direction of movement of the cloud produced by the atomic blast.

The observer in command enters all data on radiological observation of the post in the observation log (zhurnal nablyudeniya). An example of such entries is given below.

LOG OF CHEMICAL OBSERVATION POST NO. 5

Site of observation (coordinates)	Time of observation	Area of observation	Subject of observation	When and to whom reported
Elevation "Kruglaya"	1200	100 meters this side of Orientation Point No.2	Bombing near the "Uzkaya" ravine. Detection of contamination of "Uzkaya" ravine and "Zelenyy" shrubs discovered. Intensity of radiation at 0.2 roentgen per hour.	Commanding officer, 2nd Rifle Company, at 12:15

The observer in command reports the detection of radioactive contamination to his commanding officer, at whose order he gives the chemical alarm signal.

When on the defensive, in areas of concentration, after the occupation of the departure position (iskhodnoye polozheniye) for the attack, and after the disposition (of troops) in place, the chemical observation posts are set up in areas advantageous for observation, which, as a rule, are near the observation posts of the commanders of small units.

During attack and during troop movement, chemical observation posts are moved along with the observation posts of the commanders; this ensures the detection of radioactive contamination and the measuring of the intensity of radiation along the line of march. The function of the chemical observation posts is the same during deployment as it is in defense.

When troops are transported by train, the chemical observation posts are set up at the head of the echelon. In this case, the observer takes a periodic reading of the dosimeter; if he detects radioactive contamination, he reports to the chief of the echelon.

Dosimeter Patrols

Dosimeter patrols are dispatched to survey the area of troop activity or adjacent areas, in order to detect radioactive contamination, to make a reconnaissance of detected contaminated areas (determining the intensity of radiation and marking the borders of the contaminated area), and to make a preliminary survey of the site of the atomic blast.

A patrol is composed of from three to five men, one of whom is in command.

Radiological reconnaissance of roads and lines of march may be carried out in a motor vehicle (armored carrier, tank) or on foot. While on the march, one of the dosimeter operators takes a reading at intervals of from 150 to 200 meters.

If radioactive contamination of the area is discovered, a brief halt is made. The men of the patrol put on individual protective clothing and get out of the vehicle. At the order of the patrol commander, they measure the intensity of the radiation and mark off the outer limit of the contaminated area of the road (or line of march) which has a radiation intensity of 0.1 roentgen per hour. Warning signs are put up on the shoulders of the road at points where they can be seen most easily.

The commander of the patrol reports any detection of radioactive contamination to his commanding officer.

After marking off the outer limit of the contaminated zone, the patrol again gets into the vehicle (armored car, tank) and continues along the road through the area of contamination, measuring the intensity of radiation every 100 to 150 meters. This is done by stopping the car and measuring the radiation from the car. The dosimeter is held in the hand at a height of one meter from the ground.

When the patrol reaches an area in which the intensity of radiation is five roentgens per hour, the men come to a halt and mark off the border of the zone of severe contamination.

The patrol makes a detour around any area with a radiation intensity of over 100 roentgens per hour, having first marked off its border with the required warning signs.

Patrols are usually sent out in tanks for the reconnaissance of an area with a radiation intensity of over 100 roentgens per hour.

In passing through a contaminated area, a vehicle (armored carrier, tank) also becomes contaminated by radioactive substances. It is, therefore, impossible to determine the rear boundary of a contaminated zone by taking measurements from the vehicle. Having driven through a zone of severe contamination, it is necessary to measure the intensity of radiation at a distance of ten to fifteen meters from the vehicle. When the patrol has reached the rear boundary of the contaminated section of road (line of march) with a radiation intensity of 0.1 roentgen per hour, the patrol marks it off; the patrol commander reports on this to the officer who sent out the patrol.

Before setting out on reconnaissance for the purpose of detecting radioactive contamination, the patrol commander marks on a map or a sketch several routes to be followed which will provide coverage of the entire area.

Patrols in vehicles (armored carrier, tank) follow these routes and, with roentgen meters, check for radioactive contamination.

The procedure for reconnaissance in areas known to be contaminated is determined by combat conditions, the nature of the terrain, and the presence of friendly troops in the area to be surveyed.

When the area to be reconnoitered is occupied by troops, the first place in which the patrols measure the intensity of radiation is the area where the troops are located. To accomplish this, the patrol proceeds by vehicle (armored carrier, tank), or on foot if the combat situation or the terrain does not permit the use of a motor vehicle; the patrol moves in the direction of the unit (small unit) commander's observation point, measuring the intensity of radiation along the way (figure 46).

The patrol commander receives orders from the unit (small unit) commander concerning the areas to be surveyed. The patrol commander may send instrument men there, or he and the entire patrol, with an armored carrier or tank, may go to each of the areas in turn. When the survey has been completed, the patrol commander reports to the commanding officer of the unit (small unit) on the intensity of radiation in the areas surveyed.

Figure 46

[Routes taken by dosimeter patrol in surveying an area occupied by troops.]

An area not occupied by troops may also be patrolled either on foot or in a vehicle.

When a patrol detects a contaminated area, while surveying in a vehicle (armored carrier, tank), it moves along its outer limit, indicating it with warning signs. If there is no lateral boundary to the contaminated area in the strip of land to be surveyed, the patrol cuts across the contaminated area, measuring the intensity of radiation every 100 to 150 meters. When the patrol reaches the rear boundary of the contaminated area, the men mark it.

When the patrol is on foot, it proceeds as follows (figure 47):

- Dosimeter operator No. 1 goes across the contaminated zone, following the main direction to be taken by the patrol. He measures the intensity of the radiation and marks the front and rear boundaries of the contaminated area.

- Dosimeter operators No. 2 and No. 3 move out to the right and the left of the main direction. They stay on the boundary line of the contaminated area and mark it off; if the lateral boundary of the contaminated area is not located within the zone assigned to the patrol for survey, dosimeter operator No. 2 or No. 3 (in the sketch it is dosimeter operator No. 2) crosses the (contaminated) area along the edge of the strip which is being surveyed and measures the intensity of radiation; when he reaches the rear boundary of the contaminated area, he marks it, following the main direction taken by the patrol.

- The patrol commander follows behind dosimeter operator No. 1, directs the operations of the dosimeter operators, and takes control readings of the radiation intensity.

At the assembly point, the dosimeter operators report to the patrol commander on the results of the survey.

When the patrol proceeds on foot and under enemy fire, the dosimeter operators go in pairs along the routes assigned to them, keeping under cover and moving ahead in short runs or crawling from one cover to the next. When they have located the boundary of the contaminated area and determined the intensity of radiation in the area, they proceed to the assembly point, where they report the results of the reconnaissance to the patrol commander. The patrol commander accompanies one of the pair going in the main direction of the survey and directs the operations of the dosimeter operators.

Figure 47

[Diagram of operations of a dosimeter patrol when surveying a contaminated area not occupied by troops.]

When seeking a safe route through the portion of the contaminated area assigned to him, the patrol commander designates several routes at a distance of 200 to 300 meters apart. The patrol proceeds along each of these routes in turn in a vehicle (armored carrier, tank) and measures the radiation intensity every 100 to 150 meters. If it is impossible to take a vehicle (armored carrier, tank) through the area, the patrol spreads out along the front boundary of the contaminated area, and the dosimeter operators then cross the area on foot, keeping a distance of from 200 to 300 meters between one another (figure 48). At the assembly point, the patrol commander records on a sketch intensity of radiation along the path taken by each operator. He ascertains which is the most passable and the shortest and chooses the safest and most convenient of them.

Figure 48

[Diagram of operations of dosimeter patrol in search of safe route through contaminated area.]

Radiation reconnaissance of large areas and of long roads or lines of march can also be made by plane. The intensity of radiation is measured inside the plane, which flies at a height of 400 meters or less.

Functions of a Dosimeter Operator Attached to a Reconnaissance Unit, a Security Detachment, or Detachments of Traffic Control

It is the task of dosimeter operators who are part of a reconnaissance or a security /okhraneniye/ small unit or of a detachment of traffic control /otryad obespecheniya dvizheniya/ to detect in time the presence of contaminated zones in the direction (in the area) in which the security or reconnaissance unit operates. The dosimeter operators must designate these zones and determine the intensity of radiation in them. They also seek safe routes through the contaminated zones and detect spots with a high degree of radiation.

A dosimeter operator assigned to a reconnaissance or security small unit or to a detachment of traffic control usually proceeds at the head of the column of the small unit, near the commanding officer. He takes an instrument reading every 50 to 100 meters, when on the march.

When the dosimeter operator discovers radioactive contamination, he reports this to the commander of the small unit, at whose order he then measures the radiation intensity and puts up warning signs.

When it is necessary to find a detour, the dosimeter operator checks on the presence of radioactive contamination along the routes indicated by the unit commander.

If the reconnaissance or security small unit or the detachment of traffic control is motorized, the dosimeter operator determines the presence of radioactive contamination without leaving the vehicle. If he discovers contamination, a short halt is made to enable him to determine the intensity of radiation and to put up a warning sign.

3. Dosimeter Inspection

Dosimeter control (dozimetricheskiy kontrol) is one of the measures taken to protect troops from injury caused by radioactive substances. It is subdivided into inspection of radiation exposure /kontrol radioaktivnogo oblucheniya/ and inspection of radioactive contamination /kontrol radioaktivnogo zarazheniya/.

Inspection of radiation exposure consists of measuring the dosage received by personnel operating in a contaminated zone following an atomic explosion, after the use of combat radioactive substances, or while decontaminating weapons, equipment, or materiel.

Inspection of radiation exposure of troops operating in a contaminated area is subdivided into group inspection and individual inspection.

Group inspection of exposure is performed by dosimeter operators. The dosimeter operator sets up his instrument at the point in the unit's location where the intensity of radiation is at the highest; he takes readings and makes periodic reports to the commanding officer on the dosage received by personnel.

These same dosimeter operators have the task of ascertaining the intensity of radiation in areas of troop activity and of taking measures to protect them from radioactive substances.

Small ionization chambers, from the sets for individual inspection, are used in individual inspection for exposure.

The data obtained in measuring the dosage of radiation is entered in the exposure record.

Inspection of radioactive contamination (kontrol radioaktivnogo zarazheniya) of personnel, animals, weapons, technical equipment, material, and rations is performed when combat duties have been fulfilled and the troops have left the contaminated area, and also during the course of complete sanitary processing and decontamination.

Dosimeter posts, through which the troops must pass, are set up for the purpose of inspecting radioactive contamination of troops upon their departure from a contaminated area. The dosimeter operators at these posts measure the degree of contamination from radioactive substances of all personnel, weapons, and equipment.

If it is learned in the course of the inspection that the degree of contamination exceeds the safety norms, personnel are put through sanitary processing, and the animals receive treatment from a veterinarian. Weapons, technical equipment, and rations are decontaminated.

Dosimeter control during complete sanitary processing and decontamination is performed by dosimeter operators in inspection and clearing posts (kontrolno-raspredelitelnyye punkty) and by dosimeter operators at medical and decontamination sections.

4. Dosimeters (Dozimetricheskiye Pribory)

The basic instruments used in radiological reconnaissance and in dosimeter control are roentgen meters (rentgenometry), radiometers (radiometry), and dosimeters (dozimetry).

The roentgen meter is intended for use in measuring the intensity of radiation in contaminated areas.

The basic parts of the roentgen meter are the ionization chamber, a direct current amplifier, an electric meter (microampere meter), and batteries (istochniki pitaniya). The operation of the roentgen meter is based on the following principle. When beta and gamma rays enter the ionization chamber, an ionized current is produced in the chamber's circuit; this current is boosted and then measured by the microampere meter.

Figure 49

[Roentgen meter DP 1-A]

The reading of the microampere meter is in proportion to the strength of the current that is formed in the ionization chamber; it is, therefore, also proportional to the intensity of the radiation.

The roentgen meter makes it possible to measure an intensity of radiation of up to 400 roentgens per hour and to ascertain the boundaries of a contaminated zone and the portions of it that are severely and dangerously contaminated.

During reconnaissance of a contaminated locality, the roentgen meter DP 1-A is worn against the chest, and the operator watches the indicator continuously (figure 50). The carrying position for the roentgen meter is shown in figures 51 and 52.

Figure 50

[Position of the roentgen meter DP 1-A when in use.]

Figure 51

[Position of the roentgen meter for long-distance carrying.]

Figure 52

[Position of the roentgen meter when being carried short distances.]

The radiometer is used to determine the degree of radioactive contamination on various surfaces, such as the surfaces of food, water, air, clothing, and skin, when the object or person has left the contaminated area.

The contamination of various objects is measured by the amount of decomposition (raspad) of radioactive substances which takes place in one minute within one square centimeter of surface.

Figure 53 shows a radiometer of the type DP 11-A. This instrument makes it possible to measure the contamination of objects up to 600,000 decompositions per minute in one square centimeter.

Figure 53

[Radiometer DP 11-A]

The radiometer DP 11-A is used primarily to check contamination of persons, weapons, technical equipment, and supplies at decontamination stations (obmyvochno-dezaktivatsionnyye punkty). It also enables one to measure small intensities of gamma radiation (up to 0.3 roentgens per hour), which makes it possible to use radiometer DP 11-A in radiation reconnaissance of an area by plane.

The fundamental parts of the radiometer are: a meter, an electrical impulse amplifier, an impulse converter (preobrazovatel impulsov), an electric meter, and batteries.

The radiometer works on the following principle. When the beta particles and the gamma rays act on the meter, electrical impulses arise in the meter's circuit. They are first boosted and then transmitted to the impulse converter, where they are converted into direct current. The magnitude of this current, proportional to the amount of beta particles and gamma rays acting on the meter, is measured by a microampere meter.

Figure 54

/Position of radiometer DP 11-A when in use./

The two parts of radiometer DP 11-A — the sounding rod and the gauge panel — are connected by a flexible cable. The instrument is equipped with headphones for sound detection.

When in use, the instrument box is worn on the chest, while the sounding rod is held in the hand (figure 54). For detection of contamination, the sounding rod is brought to a distance of one or two centimeters from the surface suspected of being contaminated, and signals are listened for on the headphones. An uninterrupted crackling on the headphones means that the surface is contaminated. The degree of contamination of the surface is recorded on a dial.

The dosimeter is used for measuring the total dosage of radiation received by personnel while in a contaminated area.

A dosimeter called a <u>komplekt individualnogo kontrolya</u> is used in individual inspection. It consists of 200 separate ionization chambers and of a charge-gauging panel (zaryadno-izmeritelnyy pult) which measures electrical charges. The ionization chambers are small and will fit in the pocket of a tunic.

Each soldier and NCO is issued an ionization chamber of the type DP 21-A before entering a contaminated area or an area subject to atomic attack. Upon departure from the contaminated area, the chamber is turned in in order to measure the extent of the dosage with the aid of the charge-gauging panel.

An ionization chamber and the charge-gauging panel are shown in figure 55.

Ionization chambers measure dosages from zero to 50 roentgens.

Figure 55

/Set DP 21-A/

/A - Charge-gauging panel for measuring electrical charges.
B - Ionization chamber used in individual control of exposure to radiation./

V. SANITARY (VETERINARY) PROCESSING AND DECONTAMINATION

1. Organization of Sanitary (Veterinary) Processing and Decontamination

Sanitary processing for troops (veterinary treatment for animals) and the decontamination of weapons, technical equipment, clothing, and supplies have as their aim the prevention of injury to personnel from radioactive substances.

The removal of radioactive substances from the skin and the mucous membranes of the eyes, nose, and mouth of people is called sanitary processing (sanitarnaya obrabotka) and in case of animals - veterinary processing (veterinarnaya obrabotka).

The removal of radioactive substances from weapons, combat materiel, equipment, defensive works, the area, and also from water and food is called decontamination (dezaktivatsiya).

Sanitary and veterinary processing, and also decontamination, are usually carried out only in such cases in which the contamination exceeds the norms of safety. Sometimes, when it is impossible to determine the actual degree of contamination, sanitary processing and decontamination are performed as a preventive measure. In such cases sanitary and veterinary processing, and also decontamination, are never carried out at the expense of the combat objective.

Depending on the combat situation, sanitary and veterinary processing and decontamination may be fulfilled either partially or completely, and the procedure is therefore divided into partial and complete processing.

Partial sanitary (veterinary) processing and also partial decontamination are conducted in the immediate contaminated area or near it. In partial sanitary processing, radioactive substances are removed from the exposed parts of the body; in partial decontamination, from the whole area of the contaminated objects with which personnel come into contact. First comes sanitary processing, followed by decontamination. After the decontamination , partial sanitary processing is repeated.

Complete sanitary (veterinary) processing and complete decontamination are performed only in uncontaminated areas, and, as a rule, either after the fulfillment of the combat mission or during a lull in the hostilities on order of the senior officer.

In complete sanitary (veterinary) processing, radioactive substances are removed from the entire body of the person (animal).

In complete decontamination, radioactive substances are removed from all surfaces of weapons, technical equipment, clothing, supplies, and other objects. Partial dismantling of weapons and technical equipment, for the purpose of removing radioactive substances from inaccessible places, is permitted in complete decontamination.

Dosage inspection (dozimetricheskiy kontrol) to determine the degree of contamination of personnel, animals, clothing, weapons, technical equipment, and supplies is performed both before and after complete sanitary (veterinary) processing and complete decontamination.

Sanitary (veterinary) processing and decontamination are considered completed when all radioactive substances have been removed from the bodies of personnel, animals, and from contaminated objects, or when the degree of contamination has dropped to a safe level.

Decontamination stations are established at unit positions for the execution of complete sanitary processing of personnel, for veterinary processing of animals, and for the decontamination of weapons, technical equipment, clothing, and supplies. The composition of these stations is as follows:

- A section (ploshchadka) for the decontamination of weapons and technical equipment.
- A section (ploshchadka) for the decontamination of clothing and equipment.

- A section (ploshchadka) for sanitary processing.

- A section (ploshchadka) for veterinary processing (this section is set up when there are animals in need of processing).

Units which must undergo complete sanitary processing and decontamination concentrate in waiting areas (rayony ozhidaniya) (figure 56). These waiting areas are in sheltered places, at a distance of from one-half to one kilometer from the decontamination station (obmyvochno-dezaktivatsionnyy punkt).

The units may perform partial sanitary processing and partial decontamination in the waiting area, if this was not done earlier.

From the waiting area the units in turn proceed to the inspection and clearing station (kontrolno-raspredelitelnyy punkt). At this station they undergo dosage inspection. Depending on the results of the inspection, the units are sent to the decontamination station (if the degree of contamination exceeds the safe norms) or the assembly area (rayon sbora) (if the degree of contamination is less or within the allowable limit of the safe norms).

Figure 56

[Diagram showing units processing through the decontamination station.]

A unit which has been ordered to the decontamination station reports, together with weapons and technical equipment, to the contaminated half of the section for decontamination of weapons and technical equipment, where the unit personnel are assigned work positions, attire themselves in protective clothing, and proceed with the decontamination of their weapons and technical equipment, under the supervision of the decontamination specialists (khimiki-dezaktivatory) in the sections.

Having decontaminated their weapons and technical equipment, they proceed to the decontaminated half of the section for dosage inspection (dozimetricheskiy kontrol). If the contamination of weapons and technical equipment still exceeds the safe norms, decontamination must be repeated.

Following the decontamination of weapons and technical equipment, the unit personnel report to the section for the decontamination of clothing and equipment, where they remove their protective clothing and undergo dosage inspection and leave behind outer clothing and equipment to be decontaminated. (After decontamination, the clothing and equipment are subjected to dosage inspection and are taken by a special carrier (podnoschik) to the dressing room at the section for sanitary processing.) The decontamination of clothing and equipment is carried out by specially selected teams.

From the section for the decontamination of clothing and equipment, the unit personnel proceed to the section for sanitary processing (to the dressing room of the unit).

Upon completion of the sanitary processing, the unit personnel proceed to the decontaminated half of the section for the decontamination of weapons and technical equipment, where they clean and oil the decontaminated weapons and technical equipment and then report to the assembly area.

If there is a large accumulation of weapons and technical equipment at the decontaminated half of the section, the cleaning and oiling may be done at the assembly area.

If the contamination of the personnel is ten times greater than the permissible norm, the men proceed immediately to the sanitary processing section, omitting the other sections.

2. Sanitary Processing

Procedure for Partial Sanitary Processing

In partial sanitary processing the exposed parts of the body (face, neck, hands) are washed and the mouth is rinsed with clean (uncontaminated) water (figure 57). If there is a lack of water, the exposed parts of the body are wiped off with a rag, towel, or handkerchief moistened with water (figure 58).

If the processing takes place in a contaminated area, they must not take off protective clothing. Therefore, radioactive substances are removed only from the unprotected parts of the body, and this is usually done twice.

Partial sanitary processing is performed before and after decontamination of the position, weapons, technical equipment, and defenses.

Figure 57

[Washing the exposed parts of the body with uncontaminated water.]

In such cases where personnel have been in a contaminated area without means of protection, the exposed parts of the body should be washed or wiped off, after which protective clothing is put on, and the position and weapons are decontaminated. After the decontamination of the position and the weapons, it is again necessary to wash or wipe off the exposed parts of the body with damp rags.

Water from a source located in a contaminated area may be used only after a decontamination inspection of the source and on the approval of the medical inspector. If there is no water nearby or if the avialable water is not to be used, the exposed parts of the body are wiped off with rags dampened with water from a flask.

Figure 58

[Wiping off exposed parts of the body.]

If there is no clean water, a wad may be dampened with the liquid that comes in the gas-casualty first-aid kit (figure 59). In an emergency, the exposed parts of the body are wiped off with a dry wad or cloth.

In using the liquid from the gas-casualty first-aid kit, care must be taken in wiping the liquid from the face so that it does not drop into the eyes, mouth, and nose.

Figure 59

/Procedure for partial sanitary processing, with the use of liquid in the gas-casualty first-aid kit./

To clean parts which have been contaminated with radioactive substances, the wiping is done in one direction only (not back and forth); it follows as well to change the contaminated wad for a clean one.

If the circumstances permit, partial sanitary processing should be performed outside contaminated areas by the following procedure:

- Remove the protective cape, shake off the dust from the clothing, and remove the protective stockings. (In shaking off dust, it is necessary to take account of the direction of the wind, in order to avoid getting dust on oneself and others.)

- Remove the gas mask and protective gloves; after this wash the hands, and wash the exposed parts of the body two or three times, paying particular attention to cleaning of the head and the removal of dirt from under the fingernails; if there is a lack of water, wipe off the exposed parts of the body two or three times with cloths (towels, handkerchiefs, or other clean material) dampened with clean (uncontaminated) water.

- Blow the nose and carefully wash with uncontaminated water, and rinse the mouth.

In the case of wounds, burns, and other injuries, first aid is given, followed by partial sanitary processing.

Procedure for Complete Sanitary Processing

Complete sanitary processing is done in the sanitary processing section of the decontamination station.

Figure 60

/Washing under a shower during complete sanitary processing procedure./

Sanitary processing may take place out of doors, under a roof, or in tents. During cold weather, warm mud huts or heated tents are erected for complete sanitary processing.

In the larger populated areas, complete sanitary processing can be performed in the public baths.

The section for sanitary processing has a disrobing room, shower, and dressing room.

In the disrobing room, personnel turn in papers and valuables for safekeeping. After that they take off clothing and underwear and undergo dosage inspection. During the dosage inspection, each person has pointed out to him the parts of the body to which he must pay particular attention during washing.

Figure 61

/Washing with water from pans./

In the disrobing room persons with skin breaks (abrasions, scratches) receive temporary bandages for the injured parts.

The shower section is set up with shower apparatus (figure 60).

In the shower section, personnel receive soap and bast rags and are assigned in pairs to showers. The washing is supervised by a sanitation instructor. Each man going through the sanitary processing washes his hands carefully with soap and removes the dirt from under his fingernails; he washes his head, face, and neck once or twice, paying special attention in the washing of the ears, areas covered by hair , and also the washing of the eyes, and rinsing himself.

Hot water should be used for washing. In such cases where the washing section is not adequately equipped with showers and for sanitary processing in small sub-sections not near a decontamination station, the water can be heated in cooking pots, cans, metal barrels, or other metal containers. At least one bucket of water must be heated for each person.

In the absence of a shower installation, buckets, pans, bowls, or other vessels are used for washing (figure 61). Two men may not use the same vessel at the same time for washing. Regardless of the section's equipment for sanitary processing, washing is done standing up. Bathing under a shower requires ten minutes per person, while washing from a bowl takes fifteen to twenty minutes.

Figure 62

/Procedure for sanitary processing in the summer./

After departure from the showers, personnel undergo dosage inspection. If the degree of contamination proves to be less than the permissible norm, personnel proceed to the dressing room. If it is higher, they return to the showers for a second washing.

Figure 63

/Sanitary processing of a wounded man./

In the dressing room, personnel put on their decontaminated clothing or exchange pool clothing, uniform, and equipment. Bandages that were placed on injuries before the men went to the showers are replaced by fresh ones, and, if needed, other medical assistance is given.

Personnel go from the decontamination station to the assembly area.

In the summer, sanitary processing (partial or complete) may take place in a river, lake (figure 62), or other water reservoirs with running water. Representatives of the chemical and medical service choose the location for sanitary processing. The place for sanitary processing is set off for undressing, and designation is made of a place for entry and exit from the water and a section for dressing. For the complete decontamination of clothing and equipment, the place set up is near the area for undressing, taking into account the direction of the wind.

Sanitary processing in a river or lake is conducted under the supervision of the sub-section commander. A guard system for personnel, supplies, and combat equipment is set up.

The wounded and sick undergo sanitary processing in aid stations (meditsinskiye punkty) and military hospitals (figure 63).

3. Decontamination

Decontamination of Small Arms

(Carbines, Rifles, Submachine Guns, Heavy and Light Machine Guns)

The decontamination of carbines, rifles, submachine guns, and light or heavy machine guns is carried out by personnel to whom the weapons are charged.

In complete or partial decontamination, the entire surface of the weapon is cleaned.

In partial decontamination, while protective clothing is worn, four to six wads made of rags (tow) are prepared. The weapon is then placed in a vertical or inclined position, and is carefully wiped off with the rags or patches which have been thoroughly wet with water (gasoline, kerosene) or with the gas-decontamination liquid.

The gas-decontamination liquid from the individual gas-casualty first-aid kit is used only with the permission of the platoon leader.

The weapon must be wiped off from top to bottom; a clean surface of rag is exposed with each working stroke; when the cloth is soiled, it is discarded. The wiping is repeated two or three times. An unclean rag must not be immersed in the liquid used in decontamination.

Lands and grooves in the weapon are wiped off with a damp cloth wrapped around the sharp point of a wooden stick.

Clean (uncontaminated) snow may be used in the winter for partial decontamination of carbines (rifles, submachine guns, machine guns).

Partial decontamination of heavy machine guns or high calibre machine guns is performed by a crew under the direction of the unit commander, following partial decontamination of the emplacement.

Radioactive substances are removed from a machine gun with rags or patches of cloth (tow) or with a brush [bunch, tuft] (kist) thoroughly wet with water or Solution No. 2 (the can with the black top in the machine-gun-and-mortar decontamination (degazatsionnyy) kit).

Particular attention should be paid to those parts of the machine gun which are handled during firing of the gun (figure 64).

Complete decontamination of small arms is carried out at the decontamination station, in the same such order as for partial decontamination. One other method for cleaning the weapons is that in which all contaminated weapons are set up in arms racks (figure 65) or in specially designated places and are then sprayed by a hose with water from the portable tank used in chemical decontamination (in the winter, the portable decontamination tank is filled with gasoline or kerosene). If there is a vehicular refueling station (ARS) /avtomobilnaya razlivochnaya stantsiya/ or a power-driven decontamination apparatus (ADM)-/avtodegazatsionnaya mashina/ at the decontamination center, the weapons are scrubbed under a stream of water, with brushes which are in the equipment kit of the mobile decontamination center. The parts of the weapons coated with oil are wiped off with gasoline or kerosene; or, if these are not available, with dry rags.

Figure 64

/The parts of a machine gun which must be decontaminated first./

Figure 65

/Complete decontamination of arms./

Used soiled materials (rags, patches, cloths), used in decontamination are put in a prepared ditch, and, after completion of decontamination, are covered with earth.

If there is no water (gasoline or kerosene) for decontamination of weapons they are wiped off three or four times with dry clean rags or tow. For decontamination in an uncontaminated area, broom, small fagots of twigs, hay or grass may be used to brush off the weapons.

Following decontamination, the weapons are wiped dry with rags or tow.

Decontamination of Guns (Mortars)

Partial decontamination of guns (mortars) may be performed by a crew (unit) right at the firing position (within the contaminated area) or after departure from the contaminated area.

Assignment of duties among the members of the gun crew is accomplished before decontamination.

Figure 66

/Parts of gun which must be decontaminated first./

The crew, with the aid of broom or twigs, brush off the gun, and afterwards with tow (rags or patches) or brush from the artillery chemical-decontamination kit, decontaminate the sight, the panoramic sight, the elevating and traversing mechanism, and also the breech block mechanism (figure 66); then they decontaminate the other parts of the gun. The wads or brush are soaked in water (kerosene, gasoline) or with Solution No. 2 (the can with the black top).

In partial decontamination, the panoramic sight is not removed from the gun.

In the partial decontamination of mortars, it is necessary to decontaminate the sighting mechanism, the levers of the elevating and traversing mechanism, the horizontal leveling mechanism, and the breech.

Full decontamination of weapons (mortars) is carried out at the decontamination center. The entire surface of the weapon is carefully washed off under a strong jet of water from a power-driven decontamination apparatus (razlivochnoy stantsiy, motopumpa), or it may be scrubbed with water and solution by means of a brush (figure 67). Before decontamination the optical device and the entrenching tools are removed from the gun. For convenience of work and better run-off of unclean water, the barrel is pointed upward. For the accomplishment of decontamination the jet of water from the running jet and the falling spray should form an angle of 30 to 50 degrees with the washed surface.

Figure 67

[Full decontamination of gun, using power-driven decontamination appartus (ADM) at decontamination center.]

The oiled parts of the gun are cleaned by hand (they are rubbed with rags soaked in gasoline or kerosene), the gun being partially dismantled if necessary.

In order to prevent contaminated water from entering the barrel, it is covered with a muzzle cap before full decontamination of the gun (or mortar). Decontamination of the prime mover, hand arms, optical devices, and ammunition is accomplished at the same time or after the decontamination of the gun.

Sighting mechanisms and optical devices (panoramic sights, range finders, telescopic sights, compasses, telescopes, binoculars) are decontaminated at specially equipped stations (rabochiye mesta) at the section. First the dust is removed from the surface of the instruments; then the entire surface of the instruments and the glass of the lenses and eyepieces are carefully wiped three or four times with a soft cloth dampened in alcohol. The instrument case and cover are thoroughly shaken out and wiped off inside and outside with a damp rag. Following decontamination, all instruments and their parts, as well as their cases and covers, are wiped dry with a soft dry cloth and subjected to dosage inspection.

Decontamination of Ammunition

Partial decontamination of ammunition at the firing position is performed simultaneously with the decontamination of the gun (mortar). The ammunition is wiped off with a rag soaked in kerosene. In full decontamination at a decontamination center, the ammunition is wiped off with a rag (tow) soaked in gasoline (kerosene) or in water containing a solvent; it is also sprayed with water from a fire hose or scrubbed with brushes.

Following decontamination, the ammunition is wiped dry; if necessary, greased; and put away in dry packing.

If the ammunition is in a hermetically sealed container, the outside of the case is sprayed with water, or wiped off with a rag soaked in water.

Decontamination of Tanks, Self-Propelled Artillery Mounts, Armored Carriers, and Motor Vehicles

Partial decontamination of tanks, self-propelled artillery mounts, armored carriers, and motor vehicles is performed, as a rule, afer departure from the contaminated area.

Tanks and self-propelled artillery mounts are decontaminated by their crews; while armored carriers and motpr vehicles, by their drivers and those personnel singled out for assistance.

In partial decontamination of tanks, self-propelled artillery mounts, armored carriers, and motor vehicles, first of all, wipe off with a rag those parts on the turret and hull of the tank (self-propelled artillery mount) which are handled by the crew. After which decontaminate:

- In the tank (self-propelled artillery mount): The interior surface of the gun compartment and of the driving compartment and also the weapons, equipment, instruments, and operating levers located in these compartments (figure 68), wiping them with rags soaked in water (diesel oil, gasoline, kerosene).

- In a motor vehicle: The cabin interior, the steering wheel, the gear shift, and the seat.

Figure 68

[The parts of a tank which are subject to decontamination first.]

In the case of an armored carrier, wipe the interior of the body in the passenger compartment (desantnoye otdeleniye) and the armament.

Prior to full decontamination, ammunition and instruments are removed from tanks, self-propelled artillery mounts, and armored carriers; and from the motor vehicles, freight which is found on the vehicle.

The turret hatch and the driver's hatch (lyuka mekhanika-voditelya) are tightly closed, and the escape hatch and the inspection hatches in the hull floor are opened. The louvers are covered with canvas, matting, or handy materials; the slits in the cover for the sight and the machine gun are closed with rags or with wooden plugs.

After this, the tank is sprayed with water from the vehicular refueling station (vehicular decontamination machine, water pump).

In cold weather, the outer surface is rubbed down with diesel oil, kerosene, or gasoline.

The decontamination of a tank (figure 69) is carried out from top to bottom and from front to back.

When the outside has been decontaminated, the interior surfaces are carefully wiped with rags (tow) soaked in water or kerosene (gasoline, diesel oil). Soiled rags are thrown out through the escape hatch. After completion of the decontamination, the tank is wiped with dry rags and separate parts are greased.

Figure 69

[Complete decontamination of tank at decontamination center, using power-driven decontamination apparatus.]

Tractors and specialized vehicles are decontaminated in a similar manner.

Decontamination of Airplanes

Partial decontamination of planes is performed in place by wiping, with rags soaked in water (gasoline), the cabin interior surfaces, and the instruments, also the propellers, the cowling of the motors, and the cockpit enclosure. In partial decontamination, the armament is not removed from the plane.

Before full decontamination of the airplane, the cockpit enclosure, the cowls of the engines, the bomb-bay door, the hatches, and the louvers are tightly closed; the manifold, rocket projector (raketnitsa), etc., are covered with rags or with plugs.

Decontamination of the airplane begins with the processing of the exterior surfaces of the plane, starting at the top, in order to insure a good run-off of decontaminated water, carrying with it the radioactive substances.

Decontamination of Communications Equipment

On order of the leader of the communications sub-section, partial decontamination of communications equipment is carried out in place, by means of wiping off the exposed surfaces with damp rags or sweeping them off with brushes or tufts, while not interfering with communications.

Full decontamination is carried out on order of the unit commander being served.

If the radio equipment became subjected to contamination on the march, only the outer surfaces of the metal carrying cases and the carrying straps are decontaminated.

If the radio equipment became subjected to contamination while in using position, then it is necessary to decontaminate the instrument panel, the battery cable, the antenna, the counterweight (protivoves), the microtelephone, and the external surfaces of the carrying cases.

Following decontamination, all parts of the portable radio equipment are wiped dry.

Closed radio trucks are decontaminated in the same way as are other trucks. Attention is first given to decontamination of the exterior surfaces of the rear wall of the body where the entry door is located and also to the front wall of the body where the antenna is mounted. If necessary, the body interior and the apparatus in it are wiped off with damp rags.

The field cable is decontaminated by dragging it through a bath of decontamination solution (water) obtained from the pribor ozokerirovaniye /pribor: instrument or equipment; ozokerit: ozocerite; a wax-like mineral used in making candles, etc./ or through a layer of dry earth. The cable must be dried off after passing through the bath.

Field cables and pole wire equipment (shestovoye imushchestvo) already laid are not given special treatment.

Decontamination of Clothing, Equipment, and Individual Protective Clothing

Partial decontamination of clothing, equipment, and individual protective clothing (individualnyye sredstva protivokhimicheskoy zashchity) is performed by personnel in combat positions and usually follows the partial decontamination of weapons and war materiel. It may be carried out either in a contaminated area or after departure from it.

Figure 70

[One method of partial decontamination - shaking out of outer clothing.]

Partial decontamination consists of shaking out or brushing off radioactive dust from the outer clothing, equipment, and footwear (figures 70 and 71). In addition, equipment and footwear are rubbed off with tufts of hay or grass.

In warm weather, the rinsing of clothing may be done in specially designated parts of a clean body of water (figure 72).

In the winter, clothing, equipment, and footwear can be decontaminated with clean (uncontaminated) snow.

Figure 71

[One method of partial decontamination - brushing off equipment and clothing with tufts of hay or grass.]

Figure 72

[Decontamination of clothing in body of water outside the contaminated area.]

If a protective cape was worn over the uniform, only the unprotected parts of the uniform and equipment are shaken out and swept off.

Personnel must help one another in decontamination, at the same time avoiding the scattering of dust on each other.

Complete decontamination of clothing, equipment, and the individual protective clothing is carried out at decontamination centers.

Figure 73

[Beating articles of clothing in the process of full decontamination.]

Clothing subject to decontamination (tunics, trousers, overcoats, fur-lined overcoats) are hung on lines or cross beams and thoroughly beaten from ten to fifteen minutes (figure 73). The felt and cord parts of horse equipment receive the same treatment. Grease spots on the clothing are rubbed with wads of tow soaked in gasoline.

In complete decontamination, the leather articles of the protective clothing are washed off with a washing solution composition or with water.

Footwear and protective stockings (leather parts of horse equipment) for decontamination are hung on stakes and rubbed with rags soaked in water, or they may be washed with the help of a brush and a washing solution.

Equipment and gas masks are decontaminated, wiping them with rags soaked in water or in a composition of washing solution. Care must be taken that water does not get inside the gas mask.

Figure 74

[Complete decontamination of footgear and equipment.]

Decontamination of Field Shelter, Ditches, Communications Trenches, and Firing Positions

In the decontamination of open defensive works (field shelter, ditches, communications trenches) without revetments, a layer of earth up to three centimeters thick is removed from the berms, sides, traverses, and bottom. The earth may be removed from the parapet when the camouflage condition permits; if doing this is not possible, the surface of the parapet is brushed off.

In trenches, the layer of earth is removed first from the berms and then from the upper part of the revetment to the lower.

The dislodged earth is shoveled into buckets, boxes, and sacks, and either is carried away to a distance of several tens of meters from the defensive works or is buried. Then, to decontaminate, a layer of earth three centimeters thick is removed from the bottom of the trench (field shelter, communication trench).

In the winter, defensive works are decontaminated by the removal of a layer of snow four to six centimeters thick; the snow must be removed in such a way that it will not disturb the camouflage of the position (field shelter). In the absence of snow, the surfaces of the defenses, trenches, communications trenches must be swept.

Field shelters, trenches, and communications trenches with revetments, and covered entrances to buildings and to rooms are decontaminated by wiping with wet brooms, brushes, or rags; each surface must be gone over twice. Dust and trash are collected in a bucket (sack, box) and are carried away to specially designated places.

A team consisting of two men is put in charge of the decontamination of each section of trench: One of the men removes (or sweeps) the contaminated layer of earth from all surfaces subject to decontamination and shovels it into a sack (bucket or box), while the other carries away the contaminated earth to a refuse point.

Each team is assigned a section about ten to fifteen meters long.

On completion of the work or while in the process of completion, samples of the earth in the decontaminated sections are taken, and the degree of radioactivity is measured in an uncontaminated area. This makes it possible to judge the effectiveness of the decontamination.

Camouflage requirements must be taken into account in decontamination. During decontamination, ceilings and walls of rooms are rubbed down with wet brooms and the floors are washed.

In rooms with asphalt or cement floors and drains, the ceilings and walls are decontaminated by washing them down with a spray of water from a fire extinguisher (brandspoyt).

Walls and floors spattered with grease must be thoroughly scrubbed with stiff hair brushes (or with metal bristles) before being sprayed.

Decontamination of Rations and Forage

All types of rations and forage which have been contaminated with radioactive substances higher than the safe norm are subject to decontamination or disposal.

Portable supplies of rations contaminated by radioactive substances in excess of the safe norm are destroyed. An exception consists of canned goods and other products in hermetically sealed containers. After decontamination of the containers, such products are fit for consumption.

Food supplies which have been kept in storage are taken to uncontaminated areas to be decontaminated.

Food supplies and forage which can not be decontaminated are not issued as subsistence. Before decontamination all food products and forage undergo dosage inspection, in order to assort them according to the degree of contamination.

Depending on the type of food supply (forage), its packing, and the degree of contamination, the decontamination is treated in one of the following ways:

- The food (forage) is removed from contaminated into a noncontaminated packing container.

- The contaminated layer of food is disposed of.

- The contaminated foods are washed off with the spray of water from a fire extinguisher (brandspoyt).

- The packing containers are washed in warm or soapy water washing solution, and wiped with a cloth.

Loose food supplies and forage (grain, groats, flour, bran, salt, sugar) which come in sacks are poured off into clean packing containers. The sacks are put on a wooden rack, with their sewn ends upward, and then are sprinkled with water (figure 75). The bags are then opened, and the upper edges are turned down (figure 76). The contents are transferred to a clean sack with a scoop (small shovel).

Figure 75

[Spraying sacks of loose foodstuffs with the aid of a portable decontamination apparatus.]

Figure 76

[Turning down the upper edge of the sack.]

Figure 77

[Decontamination of barrel.]

If the food item has both an inner and an outer wrapping, the outer wrapping is removed, and the inside wrapper is measured for radiation. If the inner wrapping also shows contamination beyond the safe norm, the food is transferred to an uncontaminated packing container. Care must be taken to prevent the clean container from coming into contact with the contaminated container.

In the decontamination of food products (solid fats, macaroni, fish, corned beef) packed in boxes or casks, the packing containers are decontaminated first. The packing containers are hosed down with water from a fire extinguisher (brandspoyt) (figure 77) and scrubbed with brushes (with rags). Containers, boxes, and cans may also be decontaminated by being rubbed off two or three times with a rag (figure 78) soaked in water (soapy water, washing solution). Then the packing containers are inspected for radiation, and, if necessary, they are decontaminated once more. If, following the second decontamination process, the degree of contamination is still above the safe norm, the contents are transferred to clean containers and subjected to dosage inspection.

Solid fats (butter, kombizhir) are decontaminated (after determination of the degree of their contamination) by the removal of the contaminated outer layer, contiguous to the can, with a knife, a thin steel wire, or a metal scraper.

Fresh vegetables (potatoes, cabbage, carrots, beets) are decontaminated by frequent washings in water. Cabbage is washed, after removal of all of the outer, contaminated leaves. Potatoes may undergo additional decontamination in the potato cleaning machine (kartofelechistka).

Figure 78

[Decontamination of canned goods.]

Fresh meat and fish is washed off with water (figure 79), the contaminated parts being cut off if need be.

Contaminated field kitchens, thermos bottles, cooking utensils, and dishes, as well as bakery equipment and stock, are decontaminated by scrubbing carefully in hot soapy water and drying with rags.

Figure 79

[Decontamination of meat.]

Decontamination of Water Supply

In the decontamination of wells and springs that have been contaminated by radioactive substances, the water is pumped out of the well several times, and the bottom is cleaned. Each time, before the water is pumped out, the rim and the shaft are carefully washed off; in the case of a spring, a layer of earth five to ten centimeters thick is removed. Before and after the decontamination of a well or spring, the degree of contamination of the water and of the shaft walls is ascertained. At the same time the surrounding area, within a radius of fifteen to twenty meters, must also be decontaminated. The contaminated silt (sand, gravel) taken from the well is buried at some distance from the well; the contaminated water is disposed of in a place from which it can not find its way back into the decontaminated well.

The engineers decontaminate the water by filtering and distilling it.

Safety Measures in Decontamination Work

All persons engaged in the decontamination of technical equipment, weapons, clothing, and the area must wear protective clothing.

The choice of clothing which must be worn in a given instance is determined by the officer in charge of the decontamination work. He takes into account the type of project to be decontaminated, its degree of contamination, the methods to be used in decontamination, and the amount and type of protective clothing available.

Protective clothing is removed when it becomes damaged or when the job is finished, and only with the permission of the officer in charge.

Reservoirs and ditches leading into them are dug for the drainage of water from the decontamination sites. In the process of the work it is necessary to make sure that water reservoirs are not overflowed and that all wiping materials are buried in pits. When the decontamination process is finished, the reservoirs and pits are filled in.

Precautions to be taken by personnel:

- Spray and dust from contaminated objects must be kept off skin and clothing;

- Avoid contact between contaminated objects and exposed parts of the body and clothing;

- Do not sit, stand, or kneel, unless unavoidable;

- Do not eat, drink, or smoke;

- Do not throw away contaminated material but dispose of it only in specially dug pits;

- Do not touch exposed parts of the body with contaminated hands (or protective gloves).

4. Veterinary Processing

Partial veterinary processing may be performed either in a contaminated area or after departure from the area.

In partial veterinary processing, first clean off the contaminated dust with tufts of grass or hay, whiskbrooms, or brushes from the entire body of the animal and its equipment (figure 80). The gas mask, the goggles, and the areas near the mask and goggles are then wiped with a rag soaked in uncontaminated water.

Figure 80

[Partial veterinary processing of a horse, in the contaminated area.]

When animals are processed in a contaminated area, their harnesses, saddles, packs, and protective outfits are not removed. The mask and goggles and equipment may be removed if the area is not contaminated.

Following partial veterinary processing, the equipment (harness, saddle, pack) is decontaminated.

During partial veterinary processing, care must be taken that dust falling from the animal does not fall on personnel or other animals.

Full veterinary processing is performed at the decontamination center, where there is a section (ploshchadka) equipped for veterinary processing, or at a veterinary station (ploshchadka veterinarnoy obrabotki) which may have been set up near a veterinary hospital. A veterinary section consists of a decontaminated half and a contaminated half.

There are pickets (for tying up the horses) and racks (for the decontamination of equipment) in the contaminated half of the section. Showers are also to be found here (in the absence of showers, the animals are washed off with water from a fire extinguisher (brandspoyt)).

The site for the contaminated half of the section must be dry, and if possible sandy. To prevent the water from collecting in pools, drainage ditches are dug.

There is another picket line at the decontaminated half of the section; here the processed horses and other animals are dried off and receive necessary medical treatment. Moreover, on the decontaminated side of the section there are hangers and racks on which decontaminated equipment may be hung to dry.

Figure 81

[Full veterinary processing of a horse at the veterinary section of a decontamination center.]

The procedure for complete veterinary processing is as follows:

- The animal is tied on a short reign to a picket;

- The animal is thoroughly washed with water and green soap (figure 81); ordinary brushes or special shower brushes (figure 82) may be used. Special care is given to the mane, the tail, the legs, and to those parts of the body with which the harness comes into contact;

Figure 82

[Shower brush.]

- The animal's eyes, nostrils, and mouth cavity are rinsed.

The horse is then led to the decontaminated half of the section, where it undergoes dosage inspection. If the instrument reading shows that the contamination on the animal remains above the safe norm, the horse is returned to the contaminated half for repeated processing.

If the repeated processing does not lead to a lowering of the degree of contamination to the safe norm for such animals, the horse is placed under special veterinary observation.

In warm weather, veterinary processing can be done by bathing and cleaning the animals with brushes in a river, lake, or other body of water.

In cold weather, the animals are wiped dry after being washed, and then they are covered with horse blankets and walked.

Wounded, contused, and ailing horses undergo full veterinary processing at a veterinary aid station (peredovoy veterinarnyy punkt) or at a veterinary hospital.

VI. OTHER MEASURES TO ERADICATE THE CONSEQUENCES OF ATOMIC ATTACK

Among the possible consequences of an atomic explosion on an area are fires, destruction of buildings and defensive works, and rockslides (obstacles) on the roads. There may be the wounded among the obstacles or in the damaged buildings.

Emergency help and life saving. Emergency-help and life-saving groups are organized for the removal of debris blocking the egress of persons trapped in ruined buildings, for giving first aid to the wounded, and for the removal of injured personnel from the contaminated area.

This work is usually performed by special units (podrazdeleniya) composed of sappers, dosimeter operators, and medical personnel.

If the extent of the damage is small and the number of wounded is not great, the emergency-help and life-saving members of the units carry out their work without outside help.

First aid for the wounded following an atomic attack. In addition to wounds, abrasions, and contusions, a person extricated from a landslide or ruined building may have fractures or internal injuries, which are not apparent from any break in the skin. Such a victim must therefore be treated with special care when first aid is administered.

If earth has fallen into the victim's mouth, eyes, or ears, it must be removed with a piece of gauze or a handkerchief; burns and other surface wounds must be bandaged, even if they are dirty.

In giving first aid to a comrade, one must wash (wipe off) the exposed parts of his body and put a gas mask on him (figure 83).

Figure 83

[Putting gas mask on a wounded man in a contaminated area.]

If the clothes of the wounded man are burning, a shelter-half cape (plashch-palatka) (overcoat) must be thrown over him and pressed down firmly against his body (figure 84). When the flames have been extinguished, the burned clothing must be carefully removed. Clothing that sticks to the body must not be torn off. Blisters that have formed on the skin must not be opened.

As soon as possible, the burned surfaces of the body must be bandaged; the bandages in the first-aid packet may be used for this. If the clothing has stuck to the body, the bandage must be placed on top of it.

The following rules must be observed in giving first aid to the wounded:

- Do not touch a wound with your hands and do not wash it with water, in order to prevent radioactive substances from getting into it.

- Do not remove foreign bodies that have entered the wound (fragments, etc.).

It is very important to know how to apply a bandage properly. A properly applied bandage provides necessary protection from radioactive substances.

Figure 84

/Putting out burning clothing with a shelter half cape (plashch-palatka)./

The bandages in the individual first-aid packet (individualnyy perevyazochnyy paket) are used. If the first-aid packet has been damaged, the bandages in it may not be used.

Severe bleeding, which produces a great danger to life, must be stopped as soon as possible, without waiting for the wounded man to be removed from the contaminated area.

If the victim has open fractures, a tourniquet must not be applied. The wound must be bandaged.

If the victim is unconscious, he must be placed on a stretcher in such a position that his feet are higher than his head, and he must be carried out of the contaminated area. If the victim is not breathing, artificial respiration must be given.

Putting out fires. Fires that hinder the fulfillment of the combat mission and fires that constitute a danger to personnel, ammunition, and fuel must be put out first.

Brush fires and burning revetments, trenches, and ditches may be extinguished by beating the flames with wet brooms or branches.

Small segments of the defensive works (shields, doors, port covers) may be extinguished by throwing them down into the trench or pit and covering them with earth.

A fire in a tank, self-propelled artillery mount, or in a plane is put out with fire extinguishers. A gas mask must be worn when putting out a fire inside a tank or plane.

A portable decontamination apparatus (rantsevyy degazatsionnyy pribor), a pump (motopompa), or a fuel tank (avtopazlivochnaya stantsiya) may all be used for extinguishing a fire.

Forest fires may be centered in the tree tops or near the ground.

If it is near the ground, the fire can be put out by beating the flames with freshly cut branches from deciduous trees and by throwing earth on the flames. If the wind is strong and the fire is spreading rapidly, fire breaks can be cut; they must be up to four meters wide and cleared of bushes and vegetation.

In fighting a fire centered in the tree tops, it is necessary to isolate the burning sections of forest by cutting fire breaks in the path of the fire; the width of the fire break must be 1 1/2 to 2 times as great as the height of the trees.

Reconstruction of defensive works and roads. The destroyed defensive works are reconstructed by troops with the help of engineer units. Immediate attention is given to the reconstruction of gun emplacements and shelters for personnel; and afterward communications trenches, shelters for equipment, etc., are taken care of.

The reconstruction of roads may include the decontamination of certain stretches, the arrangement of detours, and the reconstruction of bridges and stream crossings.

PART III

Peculiarities of Combat Operations in Atomic Warfare

Basically, the operations of small units in atomic warfare are governed by existing regulations.

However, the use of atomic weapons with a large effective radius does introduce certain special characteristics to the organization and conduct of combat operations.

1. Offensive Combat

Engineer equipment for defense against atomic attack in the departure area assumes a role of special importance in offensive combat. In addition to the defensive works that were built during the defensive phase, it is necessary to construct shelters for combat technical personnel and equipment in the departure area. Both support forces and attack forces may be assigned to the construction of these shelters.

In the preparatory period before the attack, continuous observation and reconnaissance must be maintained for any indication that the enemy is preparing to break up our attack.

During this period, the location of the strongest centers of defense, which will be the subject of atomic attack, and the location of the front lines must be ascertained.

Troops are under the greatest threat of an enemy attack with atomic weapons when they are in the jump-off position. Camouflage is, therefore, of extreme importance at this time. Any weakness in the camouflage may reveal to the enemy our preparations for attack and make it easier for him to carry out an atomic attack against our troop concentrations.

An atomic attack may be followed by an attack with infantry and tanks, aimed at breaking up our attack. For this reason, when small units are in the jump-off position, everything must be held in readiness for the repulsion of an enemy attack with infantry and tanks.

An attack following an atomic blow must be carried out swiftly, and it requires a strong fighting spirit on the part of the troops. Reasoned initiative and determination must be displayed by commanders and leaders of all grades, including squad leaders (gun, tank). It must always be remembered that swift attack and relentless pursuit of the enemy are the best guarantee that he will be unable to make effective use of his atomic weapons. The maintenance of uninterrupted close contact in combat with the enemy is a necessary requirement for attack under atomic warfare conditions.

Individual fire weapons (machine guns, anti-tank guns, defiladed tanks, et al.) will remain intact when the enemy's defenses have been subjected to atomic attack. Small attacking units must thrust through the gaps, attack the flanks and rear of the surviving centers of enemy resistance, and destroy them with the help of neighboring small units.

Areas of radioactive contamination with a low level of radioactivity must be negotiated with a rapid forward thrust. When possible, seriously contaminated areas should be avoided. In order to avoid a mix-up among the units, orders and instructions for by-passing a contaminated stretch are issued by the senior commander (vyshestoyashchiy nachalnik) present.

An enemy attack with atomic weapons during the course of our attack may not serve as grounds for cessation of combat. When a unit has been subjected to the effects of an atomic explosion, order must be restored rapidly, and the troops must proceed with determination to the fulfillment of the combat mission.

Small units in rear echelons must be prepared at all times to replace units in the assault echelon that have suffered severe losses as the result of atomic attack, and they must proceed swiftly to exploit their success until the fulfillment of the combat mission.

2. Defensive Combat

An additional requirement for defenses in atomic warfare is that they must also be antiatomic defenses.

Organization of the ground by engineer work must provide protection for personnel, equipment, and weapons not only from artillery shells and conventional bombs but also from atomic weapons.

The use of atomic weapons by defensive troops increases the effectiveness of the defense, because it facilitates the repulsion of an enemy attack. An atomic blow may be dealt against attacking enemy forces either at the jump-off position or in battle.

The role of small units assumes a greatly increased importance in defensive combat. Following an atomic attack by the enemy, these units must be able to continue fighting without being in communication with adjacent units or higher command. Each squad, tank, or gun crew must fully fulfill its combat mission. The success of the counterattack organized by higher command and the annihilation of enemy forces will depend on the stamina of these small units.

Sub-units that have not been subjected to atomic attack must render assistance to adjacent units which have fallen under atomic attack, either with supporting fire or, if necessary, by counterattack.

3. Troop Movements and Disposition of Halted Troops.

During troop movements, the troops are in the greatest danger of atomic attack when they are in narrow passes, on bridges, at loading and unloading points, passing through thickly populated areas, at railroad junctions; and when they are crowded together at halts, rest areas, or areas of concentration.

For this reason, everything possible is done to prevent the concentration of troops during troop movements at points subject to atomic attack. Of great importance are the following: Dispersion of troops in narrow passes, at halts, in waiting areas, and at assembly points; utilization of existing natural cover and camouflage; strict observation of camouflage measures; skillful choice of march routes.

As a rule, troops march only at night. Strict camouflage discipline is enforced on the march and during halts.

Radioactivity reconnaissance by troops is performed systematically along all march routes.

The places chosen for halts and rests must provide cover for the troops.

Natural cover is utilized in areas where troops are disposed for a halt; the simplest kind of shelters (slit trenches) are constructed and, if time permits, are improved.

Reserves of water and other decontamination materials are kept in each car of the troop train (voinskiy eshelon), for use in partial sanitary processing and decontamination.

If the troops are being transported by rail, the troop trains (voinskiye eshelony) do not stop at contaminated stations. Personnel must protect themselves, in such a case, against radioactive contamination, i.e., put on gas masks, close the windows, doors, and ports for ventilation.

4. Action in Case of Atomic Alert.

The atomic alert is given by the aircraft warning service (VNOS) when there is immediate danger of atomic attack.

The signal for the atomic alert is established by the senior officer in the command (starshiy nachalnik). The signal may be visual or oral; it must be known to all personnel of the unit.

The signal must be brought to the attention of all personnel. All commanders, including squad leaders (gun, tank) must make certain that their personnel have received the signal.

Under any combat situation, when the signal for an atomic alert is given, protective clothing must be held in readiness (nagotove).

Action to be taken by personnel when the signal for an atomic alert is given is determined by the small unit commander and will depend on the situation.

If the unit is not engaged in combat at the time the alert is sounded, all personnel must take measures to protect themselves from injury. Weapons, tanks, self-propelled artillery mounts, and motor vehicles are placed under cover. Covers are put on the guns (either standard gun covers or improvised ones). When the alert is sounded, personnel take to overhead cover, recesses, or shelters. In order to prevent fires, the fires in the stoves in shelters (dugouts) must be put out, kerosene lamps must be extinguished, and flues and air vents must be covered. The doors to the shelter must be tightly closed.

When the signal for an atomic alert is given, if there are no prepared shelters, personnel must make use of natural shelter and available objects.

A halt is not called if the signal for an atomic alert is given when troops are on a march. Gas masks and shelter half capes are put on. Drivers stay in their places in the column.

Observers watch the vehicles ahead and watch for signals from the unit commanders.

When the signal for an atomic alert is given, all ports in tanks and self-propelled artillery mounts are closed.

In a troop train, all windows and doors are closed when the signal for an atomic alert is given. Protective clothing is held in readiness.

5. Action During and After an Atomic Blast

During an atomic explosion, regardless of other circumstances, all personnel must take measures for protection from the destructive effects of the atomic blast. The duration of this period is usually a few minutes.

Only a few seconds intervene between the flash of the atomic blast and the arrival of the shock wave (the time depends on the distance from the site of the explosion). However, the interval is long enough to permit one to take cover a few steps away. When the flash is seen, personnel must immediately take cover in a prepared shelter (overhead cover, recess) or in a natural shelter, such as a pit, a ditch (figure 85), a shell hole (figure 86), or behind a hill (figure 87), stone wall (figure 88), embankment, etc.

If there is no shelter nearby, it is necessary to lie prone on the ground with the face down. The hands must be kept under the body. This position will minimize the effect of the shock wave and protect the exposed parts of the body from being burned by the flash. The eyes must be kept closed. This prevents temporary blindness. The best position for a person in an exposed place during an atomic explosion is shown in figure 89.

Figure 85

[Position of man in ditch during atomic explosion.]

The same action is taken in an open trench or ditch. It provides protection from the shock wave, the flash, and penetrative radiation.

Figure 86

[Position of person in a shell hole during an atomic explosion.]

Figure 87

[Position of a person behind a hill during an atomic explosion.]

Personnel inside a tank must close the ports and louvers when they see the flash from an atomic blast.

One can take cover behind a tank or a self-propelled artillery mount when the flash is seen (figure 90).

Following the explosion, protective clothing must be put on, in case the area should be contaminated.

Usually an enemy attack may be expected following an atomic explosion. Therefore, immediately after the explosion, preparations to repulse attacks must be made and continuous observation maintained for signs of the enemy.

Figure 88

[Position of person behind stone wall during atomic explosion.]

Figure 89

[Most advantageous position in open terrain during an atomic explosion.]

Figure 90

[Taking cover behind a tank during an atomic explosion.]

6. Procedure in Contaminated Areas

In many cases, the situation will demand that combat operations be carried out in an area contaminated with radioactive substances. For the prevention of injury from radioactive substances, the following rules must be observed.

In crossing a contaminated area, protective clothing, shelter half cape, cotton overalls, etc., must be worn.

Personnel in motor vehicles must close the windows and louvers and protect the weapons from dust (figures 91 and 92). In passing through a contaminated area in a tank or self-propelled artillery mount (figure 93), all ports must be closed; the ventilator in the gun compartment must be turned off; and, if possible, the louvers should be closed.

In crossing a contaminated stretch of area on foot (figure 94), move quickly.

If the movement is being made under enemy fire, personnel must cover the ground in short dashes, and when dropping to the ground keep under them their cape-bedcloths (nakidka-podstil), shelter half cape, or some improvised means of protection (figure 95).

When entrenching in a contaminated area, the top layer of earth must be removed and carefully dumped on a downwind side, being careful not to get dust on oneself or a comrade; when the pit has been dug, a breastwork of uncontaminated earth is built (figure 96).

One should not lie down or sit down in a contaminated area or handle exposed objects, unless it is absolutely unavoidable.

One should not drink, smoke, or eat, because, in this way, radioactive substances might enter the body.

Figure 91

[Traversing a contaminated area in an armored carrier.]

Figure 92

[Traversing a contaminated area in a truck.]

Figure 93

[Traversing a contaminated area on a tank.]

Figure 94

[Traversing contaminated area on foot.]

Figure 95

[Traversing contaminated area under enemy fire.]

Figure 96

[Entrenching in contaminated area, using bedcloth (podstil).]

7. Duties of NCOs When Atomic Weapons are Employed in Combat

General Duties

In combat under atomic warfare conditions, a sergeant must give special attention to the maintenance of high morale and political enthusiasm among his men and of the maintenance of combat preparedness. In offensive combat, the unit commander must maintain among his men an offensive spirit and a determination to destroy the enemy, but in defensive combat he must secure stamina and doggedness.

An NCO must:

- Know the combat characteristics of atomic weapons and the conduct of combat operations in atomic warfare.

- Know how to lead the men of his unit in a contaminated area.

- Know the methods and means for defense against the destructive effects of atomic weapons.

- Be skillful in organizing the construction of defensive works and in making use during combat of natural protection offered by the terrain.

- Check frequently on the combat readiness of the protective equipment.

- Always protect the weapons and equipment in his unit and the portable food supplies and water from contamination by radioactive substances.

- Be thoroughly acquainted in and instruct his men in the signals for atomic and chemical alerts and the procedure to be followed when the signals are given.

- Be able to organize teams for giving assistance to the wounded, for fire fighting, for reconstruction of defensive works, and for partial sanitary (veterinary) processing and decontamination.

- Continue to widen his knowledge and experience in antiatomic defense and to broaden the knowledge and experience of his men.

Squad leaders (gun, tank) and their assistants must:

- See that their subordinates observe the rules governing actions in an area contaminated with radioactive substances.

- Maintain a supply of materials for use in partial sanitary processing of personnel, partial veterinary processing of animals, and partial decontamination of weapons and equipment.

- Take measures to prevent fires in trucks and tractors, which could result from the light flash; check on the presence and condition of fire extinguishers and see to it that no inflammable materials (greasy rags, rags soaked in gasoline, etc.) are kept inside the trucks; see to the removal of dry branches, brushwood, boards, and hay from the neighborhood of the unit position, when the unit is situated in a forest or a populated area.

- Arrange for the proper storage of ammunition (shells, mines) at firing positions.

- Execute the platoon leader's orders in the performance of sanitary processing and decontamination.

The first sergeant (starshina) in a company (battery) must:

- Provide his sub-unit in good time with the materials used in sanitary (veterinary) processing and decontamination.

- Check on the proper storage of the emergency rations (NZ) in his charge, to protect them from radioactive contamination.

- Organize, on order of the company (battery) commander, the sanitary processing and decontamination work for the company (battery).

- See that company supplies (spare underclothing, footwear) are properly stored for protection from radioactive contamination.

- Organize the digging of ditches for trucks (prime movers), and take measures to protect the trucks from the effects of the flash.

- Keep a record of the personnel's exposure to radiation.

The company (battery) instructor in sanitation must:

- Know the injurious effects of atomic weapons.

- Be able to give first aid to the wounded in a contaminated area.

- Be able to organize teams of stretcher bearers among unit personnel for the purpose of searching for and assembling the wounded and carrying them out of the zone of the atomic blast.

- See to it that personnel are always supplied with individual first-aid packets and gas-casualty first-aid kits.

- Insure timely training of unit personnel with first-aid packets.

- Enforce the observance of safety regulations pertaining to the use of food and water in combat operations in atomic warfare.

- Know how to take a sampling of food or water for determination of its radioactive contamination.

- Enforce the observance of safety regulations in sanitary processing and decontamination.

- Instruct the personnel of the sub-unit in the methods of self-help and mutual assistance under atomic attack and in carrying out the safety regulations governing conduct in a contaminated area.